METAL SHOW ISSUE

The Welding Engineer

ume XXVII
mber 10

October
1942

IONEER BUSINESS AND TECHNICAL JOURNAL OF THE WELDING INDUSTRY

OCT 12 1942

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Model B-5**
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Semi-insulated

Model B-4**
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it is 1¼" shorter

Model B-3*
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Semi-insulated

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Semi-insulated

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The Welding Engineer

Vol. XXVII, No. 10 October, 1942

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WITH PREHEATING · WITH PRECOMPRESSION

The Welding Engineer

AMERICA'S PIONEER WELDING JOURNAL

Established 1916

Scrap Intelligently

The current campaign to provide adequate scrap for steel production is causing confusion in the industries using welding and cutting. Many users of these modern fabricating methods have learned to make good use of "so-called" scrap.

Their problem is: "What should be scrapped?" The answer, now as it always has been, is to scrap materials intelligently.

A shop should not be cluttered with scrap, rubbish or other materials which present a fire and safety hazard. On the other hand, neither is it advisable to discard materials that may be utilized in production.

Elsewhere in this issue will be found the concluding article of a series telling how flame-cutting and allied processes are used to obtain small pieces of steel from scrap. This is one time that scrap isn't scrap—it's a valuable piece of hard-to-obtain steel.

Welding has long been the most economical means of repairing and reclaiming broken and worn machinery and equipment. The users of welding are acquainted with its possibilities in maintenance and repair fields; others who are not so fortunate might overlook a good bet. If they do, they will scrap something that isn't scrap.

We need scrap, but scrap intelligently!

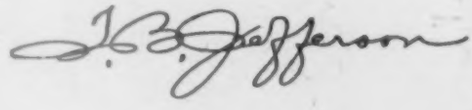
To the present scrap campaigns will be contributed many items which must soon be replaced. These can hardly be considered intelligent contributions.

The whole idea of the scrap collection is to obtain materials to produce additional steel for our war effort—not to make new items for worn articles given in patriotic enthusiasm.

If there is a part, a machine or any unit in your plant which is scrap—scrap it. If it is a vital part which must be replaced—repair it. One way to win the war is to conserve material, and the best conservation methods are found in repairs by welding.

When welding will reclaim a needed item, don't scrap it. The scrap value of needed articles totals little compared to the loss our war effort will suffer through the diversion of new materials to replace them.

Scrap, yes, but scrap intelligently!



IT'S THE OFFENSE THAT WINS BATTLES

Since 1940, the Nazis have won battle after battle. Why? Because they've waged one offensive after another.

ALTER EGO: Yes, but they've been able to do that. They started their *war production offensive* 10 years ago so they had a big edge on us in tanks, planes and guns. Then we really started competing.

So competition forces progress. *Look how in two years, our* production offensive *has already surpassed that of the Axis—turning out better weapons and more of 'em. These new arc welded M-4 tanks, for example. They'll soon be in our fighting offensive.*

ALTER EGO: It's thrilling but don't let it get us complacent. Haven't we learned never again to be caught unprepared in war . . . or in *business competition* either?

There you have it! Let's start TODAY waging a planning and designing offensive *so we'll be on the alert with better welded products and lower costs to get the upper hand on our competition the minute the post-war Battle for Business begins!*

Ask your inner self if it isn't the offense that wins battles.

THE LINCOLN ELECTRIC COMPANY
CLEVELAND, OHIO

then I said to myself—

IT'S A GREAT JOB —WELD DONE!

When welding engineers meet in downtown Cleveland (with its convenient auditorium and hotels), many war production problems will be forever removed as obstacles to Final Victory

Welding Society Meets

Cleveland and the Hotel Cleveland will be the meeting place for welding engineers and production men convening at the 23rd Meeting of American Welding Society.

War Production, the foremost problem of industry, will be the principal subject under discussion at the technical session of the forthcoming 23rd annual meeting of the American Welding Society. This meeting will be held in Cleveland, October 12th to 15th, with the Cleveland Hotel as the Welding Society's headquarters. The 1942 meeting will differ from those in the past in that social activities have been put aside for concentrated thinking on war production and the use of welding in the war effort.

Shortened by one day, this year's four day meeting has been designed for the busy business man. It will be held simultaneously with the meetings of American Society for Metals, the Wire Association, and the Steel and Metal Divisions of the American Institute of Mining and Metallurgical Engineers. The tentative program calls for the presentation of 55 papers on various phases of welding in war production and war production welding problems.

The annual meeting will be called to order Monday morning, October 12th, by Col. G. F. Jenks, president of the American Welding Society. Following the presentation of medals and prizes the first technical session will begin at 10:15. This session will be devoted to the training of welding operators and qualifications with Mr. K. L. Hansen as chairman and Mr. E. T. Scott, vice-chairman. At this session there will be presented two technical papers outlining the thoughts of government and industry in the training of weldors.

On Monday afternoon there will begin simultaneous technical sessions, which will continue morning and afternoon up until Thursday noon. Thursday afternoon will be devoted to the annnal business meeting of the Society, followed by the board of directors' meeting, which will conclude the program for the 23rd annual meeting. The various technical sessions will include papers covering testing, war production, weldability of steel, aircraft welding, gas cutting, resistance welding, production welding, welding and cutting of ordnance, ship building, and non-destructive testing and inspection.

For evening activities the visitors at the annual meeting will find much of interest in Hotel Cleveland's Rose Room. On Monday evening this will be the setting for a series of motion pictures discussing welding. On Tuesday evening, the Fundamental Research Conference will be held in the Rose Room, while Wednesday evening there will be a meeting of section officers.

The business meeting of the Society, at which the President will give his annual report followed by the election and installation of the 1942-43 officers, will take place at 2 p.m. Thursday. Immediately following the business meeting will be held the annual meeting of the board of directors of the Society, thus bringing to a close what is believed will be a highly informative week of welding progress. On the following pages will be found the tentative program of the technical sessions of the 23rd annual meeting of the American Welding Society.

Program for the 23rd Annual AWS Meeting

Hotel Cleveland, Cleveland, Week of October 12, 1942

MONDAY, OCTOBER 12th

9:30 A.M.—Morning—Opening Session

Chairman: G. F. JENKS, President, American Welding Society. Vice-Chairman: E. V. DAVID, Chairman, Convention Committee.

PRESENTATION OF MEDALS AND PRIZES

10:15 A.M.—Technical Session

TRAINING OF WELDING OPERATORS AND QUALIFICATIONS

Chairman: K. L. HANSEN, Harnischfeger Corp. Vice-Chairman: E. T. SCOTT, Cleveland School of Welding.

"Training of Welding Foremen," by F. H. ACHARD, Supervisor of Training, Consolidated Edison Co. of New York, Inc.

"Instruction Methods in Welding Developed by U. S. Office of Education," by H. K. HOGAN, U. S. Office of Education.

OPENING METALS EXPOSITION
12:00 Noon

2:00 P.M.—Monday Afternoon—Simultaneous Technical Sessions

FATIGUE AND IMPACT

Chairman: A. E. GIBSON, Wellman Engineering Co. Vice-Chairman: F. L. PLUMMER, Hammond Iron Works.

"Fatigue Strength of Metal Subjected to Combined Stresses," by L. H. DONNELL, Illinois Institute of Technology.

"Fatigue Strength of Commercial Butt Welds in Carbon Steel Plates," by W. M. WILSON, University of Illinois.

"Fatigue Tests of Full Thickness Plates with and without Butt Welds," by E. C. HUGE, The Babcock & Wilcox Co.

"Impact Strength of High Alloy Steel Welds," by E. C. CHAPMAN, Combustion Eng. Co.

DAVID ARNOTT, president-elect of the American Welding Society

WAR PRODUCTION

Chairman: R. J. KRIZ, The James H. Herron Co. Vice-Chairman: A. F. DAVIS, The Lincoln Electric Co.

"Some Special Applications of Flame-Hardening," by STEPHEN SMITH, Air Reduction Sales Co.

"High Quality Welding—Vertical and Overhead Positions with Alternating Current," by H. O. WESTENDARP, General Electric Co.

"Conservation and Effective Use of Equipment and Supplies for Welding and Cutting," by H. ULLMER, The Linde Air Products Co.

"Welding Gun Mounts," by W. B. LAIR, York Safe and Lock Co.

7:30 P.M.—Monday Evening

MOTION PICTURE FILMS

"The Inside of Welding"—Educational film by General Electric Company.

"The Welding of Aluminum"—Aluminum Company of America.

"The Welding Technique"—Oklahoma A. & M. College.

INDUSTRIAL RESEARCH DINNER—Rose Room

TUESDAY, OCTOBER 13th

9:30 A.M.—Morning—Simultaneous Technical Sessions

WELDABILITY OF STEEL

Chairman: A. B. KINZEL, Union Carbide and Carbon Res. Labs. Vice-Chairman: A. E. MARBLE, Firestone Tire & Rubber Co.

"What Happens to Residual Stresses in Service," by J. T. NORTON and D. ROSENTHAL, Massachusetts Institute of Technology.

"Effects of Cooling Rate on the Properties of Arc Welded Joints," by W. F. HESS, Rensselaer Polytechnic Institute.

"Weld Quench Gradient Tests," by W. H. BRUCKNER, University of Illinois.

AIRCRAFT WELDING—FUSELAGE

Chairman: P. H. MERRIMAN, The Glenn L. Martin Co. Vice-Chairman: J. F. MAINE, Republic Structural Iron Works.

"Welding of Airplane Propeller Blades," by C. A. LIEDHOLM, Curtiss-Wright Corp.

"Welding of New Types of Alloy Steels for Aircraft Structures," by A. R. LYTLE and K. H. KOOPMAN, Union Carbide and Carbon Res. Labs.

"Effect of Current on the Welding of X4130 Sheet and Tubing," by W. T. TIFFIN, University of Oklahoma.

2:00 P.M.—Tuesday Afternoon—Simultaneous Technical Sessions

WELDABILITY OF STEEL

Chairman: C. H. JENNINGS, Westinghouse Elec. and Mfg. Co. Vice-Chairman: G. B. CARSON, Case School of Applied Science.

"Weldability of Carbon-Manganese Steels," by O. E. HARDER and C. B. VOLDRICH, Battelle Memorial Institute.

"Weldability Tests of Carbon-Manganese Steels," by C. E. JACKSON, M. A. PUGACZ and G. G. LUTHER, Naval Research Lab.

"Jominy End Quench Hardenability Tests on Carbon-Manganese Steels," by G. A. TIMMONS, Climax Molybdenum Company.

"T-Bend Tests on Carbon-Manganese Steels," by L. C. BIBBER and J. HEUSCHKEL, Carnegie-Illinois Steel Corp.

AIRCRAFT WELDING—SHEET

Chairman: G. O. HOGLUND, Aluminum Company of America. Vice-Chairman: JOHN D. GORDON, Taylor-Winfield Corp.

"Spot Welding in Aircraft Structures," by E. S. JENKINS, Curtiss-Wright Corp.

"Standards and Recommended Practices and Procedures for Spot Welding Aluminum Alloys," by G. S. MIKHALAPOV, Chairman, Aircraft Welding Standards Committee.

"Arc Welding of Magnesium Alloys," by W. S. LOOSE and A. R. ORBAN, The Dow Chemical Co.

"Welding—Its Application to Aircraft," by FRANCIS H. STEVENSON, Vega Aircraft Corp.

GAS CUTTING

Chairman: J. R. DAWSON, Union Carbide and Carbon Res. Labs.
Vice-Chairman: O. L. SMITH, Weldit Acetylene Co.
"Gas Cutting in Steel Mills," by S. D. BAUMER, Air Reduction Sales Company.
"Improved Methods of Machine Flame-Cutting," by H. E. ROCKEFELLER, The Linde Air Products Co.
"Factors Affecting the Accuracy of Ordnance Machine Cutting," by HOWARD HUGHEY and A. H. YOCH, Air Reduction Sales Co.
"Gas Cutting in Shipbuilding," by R. F. HELMKAMP, Air Reduction Sales Co.

7:30 P.M.—Tuesday Evening

FUNDAMENTAL RESEARCH CONFERENCE
H. C. BOARDMAN, Chairman, Presiding.

WEDNESDAY, OCTOBER 14th

9:30 A.M.—Morning—Simultaneous Technical Sessions

RESISTANCE WELDING

Chairman: G. N. SIEGER, S-M-S Corporation. Vice-Chairman: B. L. WISE, Federal Machine & Welder Co.
"Refrigerant Cooled Spot Welding Electrodes," by F. R. HENSEL, E. I. LARSEN and E. F. HOLT, P. R. MALLORY & Co.
"Spot Welding of 0.040 in. Thickness SAE X4130 Steel," by W. F. HESS and D. C. HERRSCHAFT, Rensselaer Polytechnic Institute.
"Unusual Resistance Welding Developments and Operations," by R. T. GILLETTE, General Electric Co.
"Resistance Welding Trench Mortar Fin Assembly," by J. H. COOPER, Taylor-Winfield Corp.

PRODUCTION WELDING

Chairman: O. B. J. FRASER, International Nickel Co. Vice-Chairman: D. H. COREY, The Detroit Edison Co.
"Welding with Aluminum Bronze," by CLINTON E. SWIFT, Ampco Metal, Inc.
"Adapting Automatic Electric Welding to Routine Production," by J. M. KEIR, The Linde Air Products Co.
"Welded Steel Tube and Its Application in War Production," by H. S. CARD, Formed Steel Tube Institute.

2:00 P.M.—Wednesday Afternoon—Simultaneous Technical Sessions

RESISTANCE WELDING

Chairman: R. E. POWELL, Western Electric Co. Vice-Chairman: J. D. TEBBEN, P. R. Mallory & Co.
"The Spot Welding of NAX HighTensile Steel," by C. R. SCHRODER, Great Lakes Steel Corp.
"Application of Copper Oxides Rectifiers for Resistance Welding," by R. L. BRIGGS, Thomson Gibb Electric Welding Co.
"The Effect of Weld Spacing on the Strength of Spot-Welded Joints," by R. DELLA-VEDOVA and M. M. ROCKWELL, Lockheed Aircraft Corp.
"Preparation of Aluminum Alloy for Spot Welding," by T. E. PIPER, Northrop Aircraft, Inc.

WELDING AND CUTTING OF ORDNANCE

Chairman: H. L. R. WHITNEY, War Production Board. Vice-Chairman: H. C. BOARDMAN, Chicago Bridge & Iron Co.
"Manual and Automatic Welding of Heavy Plate of Hardenable Alloys," by L. A. DANSE, Cadillac Motor Car Co.
"Developments in Cast Iron Welding Rods and Electrodes," by R. J. FRANKLIN, Chicago Hardware Foundry Co.
"Electric Welding of Mobile Artillery Gun Carriages," by G. E. CAMPBELL, Pettibone-Mulliken Corp.

SHIPBUILDING

Chairman: DAVID ARNOTT, American Bureau of Shipping. Vice-Chairman: A. L. PFEIL, Universal Power Corp.
"Suggested Methods Which Will Increase Welding Production and Decrease Welding Costs," by J. F. LINCOLN, Lincoln Electric Co.
"Distortion and Shrinkage Problems in Ships and Other Large Structures," by LAMOTTE GROVER, Air Reduction Co.
"Motor Boat Construction and Small Ships," by W. E. WHITEHOUSE, Defoe Shipbuilding Co.
"Application of Welding in Submarine Construction," by E. H. EWERTZ, Electric Boat Co., and R. D. WEST, Manitowoc Shipbuilding Co.

7:30 P.M.—Wednesday Evening

SECTION OFFICERS' DINNER AND CONFERENCE

THURSDAY, OCTOBER 15th

9:30 A.M.—Morning—Simultaneous Technical Sessions

AIRCRAFT WELDING

Chairman: S. L. HOYT, Battelle Memorial Institute. Vice-Chairman: E. VOM STEEG, General Electric Co.
"Utility Characteristics of Aircraft Electrodes," by C. B. VOLDRICH and R. D. WILLIAMS, Battelle Memorial Institute.
"Results of Survey on Current Arc Welding Practice in Aircraft Industry," by MAURICE NELLES, Chairman, Western Aircraft Welding Committee.
"Copper Welding for Aircraft," by T. V. BUCKWALTER, Timken Roller Bearing Co.

NON-DESTRUCTIVE TESTS AND INSPECTION

Chairman: J. J. CROWE, Air Reduction Sales Co. Vice-Chairman: O. R. CARPENTER, Babcock & Wilcox Co.
"Correlation of Metallographic and Radiographic Examinations of Spot Welds in Aluminum Alloys," by DANA W. SMITH and FRED KELLER, Aluminum Company of America.
"The Magnetic Powder Method for Inspecting Weldments and Castings for Sub-Surface Defects," by CARLETON HASTINGS, Watertown Arsenal.
"Radiographic Inspection of Welded Armor Plates and Castings," by DON M. MCCUTCHEON, Ford Motor Co.
"Visual Inspection of Arc Welds," by W. L. WARNER, Watertown Arsenal.

2:00 P.M.—Thursday Afternoon

BUSINESS MEETING

3:00 P.M.—Thursday Afternoon

BOARD OF DIRECTORS MEETING

COL. G. F. JENKS, *retiring president of the American Welding Society*

★ **METALS**

The Cleveland Public Auditorium where the 1942 National Metal Congress will be held the week of Oct. 12.

War Production Conference

Cleveland will be the scene of America's War Conference on Metals which will bring out the new products, new production equipment and ideas developed as a result of the war.

THE WAR PRODUCTION EDITION of the National Metal Exposition and the 1942 National Metal Congress will be held in the Cleveland Public Auditorium the week of October 12. The theme of the 24th National Metal Congress and Exposition, which will be along war production lines, is far different than any previous edition of this history-making metal event. The keynote of this year's meeting will be education—education that will be devoted solely to increased production of war products. All of these ideas will be depicted by means of ingenious displays, working models and, in some cases, actual demonstration of the problem involved.

The doors of the exposition will open at 12 noon, Monday, October 12, and will remain open every afternoon and evening until 10:30 with the exception of Thursday evening. On Thursday, the exposition will close at 6 p.m. to allow those attending the exposition to attend the annual banquet of the various societies in technical session in connection with the Metal Congress. Admission will be free to all members of the technical societies participating and to those holding executive passes.

The 1942 Congress and Exposition will be one of the largest in the 24 year history of this event. There will be more than 200,000 square feet of exhibit space, which will be devoted to class rooms, lecture halls, conferences, and display spaces. More than 250 exhibitors are participating, representing every branch of metal and associated industries.

In conjunction with the Congress, there will be held 25 war production sessions patterned after the successful defense meetings at last year's Congress. Outstanding authorities in government and industry will speak briefly, informally, and off the record, on the important phases of these 25 timely topics. All speakers will later act as members of an information panel for open discussion.

Thus, gathered in one place, at one time, will be the outstanding authorities on the manufacture, production, and fabrication of metals that are so important to our war production program. The meeting might be likened to a great university with a faculty of thousands of technical and production wizards who are anxious and willing to discuss, council, and advise as to how we can do more with what we have.

As a special aid to all visitors, THE WELDING ENGINEER has listed on this and the following pages the exhibitors who will participate in the Metal Congress.

EXHIBITORS

Acme Electric Welding Co., Huntington Park, Calif. (Booth A-500)
Advance Polishing Wheels, Inc., Chicago. (Booth E-113)
Agfa Ansco Div., General Aniline & Film Corp., Binghamton, N. Y. (Booth C-238)
Alloy Castings Co., Champaign, Ill. (Booth No. B-502)
Alox Corp., Niagara Falls (Booth B-516)
Aluminum Co. of America, Pittsburgh. (Booth C-421)
Aluminum Ore Co. (Booth C-421.) See Aluminum Co. of America.
Alvey Ferguson Co., Cincinnati (Booth S-162)
American Brake Shoe & Fdry., New York City. (Booths A-525 and B-320)
American Brass Co., Waterbury, Conn. (Booth A-321)
American Car and Foundry Co., New York. (Booth B-314)
American Foundry Equipment Co., Mishawaka, Ind. (Booth D-340)

American Gas Furnace Co., Elizabeth, N. J. (Booth B-103)
American Institute of Mining and Metallurgical Engineers, Inc., New York. (Booth B-508)
American Machine and Metals, Inc. (Booth A-418.) See Riehle Testing Machine Div.
American Machinist, New York. (Booth E-137)
American Magnesium Corp. (Booth C-421.) See Aluminum Co. of America.
American Manganese Steel Div. of American Brake Shoe & Fdry. Co., Chicago Heights, Ill. (Booth A-525)
American Metal Market, New York. (Booth D-319)
American Society for Metals, Cleveland.
American Welding Society, New York. (Booth A-427)
Ampco Metal, Inc., Milwaukee, Wis. (Booth B-131)
Anderson & Brown Co., Cleveland. (Booth B-137)
Anderson & Sons, Westfield, Mass. (Booth B-421)
Andresen, Inc., Pittsburgh. (Booth B-210)
Armstrong Cork Co., Lancaster, Pa. (Booth D-138)
Atlas Fdry. Co., Detroit. (Booth B-320)
Atlas Publishing Co., New York City. (Booth C-229)
Atlas Steels Ltd., Welland, Ont., Canada. (Booth D-113)
Automatic Temperature Control Co., Inc., Philadelphia. (Booth E-117)
Automotive and Aviation Industries, Philadelphia. (Booth C-203)
Babcock & Wilcox Co., New York. (Booth C-325)
Baker & Co., Inc., Newark, N. J. (Booth B-415)
Banner Iron Works, St. Louis. (Booth B-320)
Barnett Fdry. & Machine Co., Irvington, N. J. (Booth B-320)
Bastian-Blessing Co., Chicago. (Booth C-131)
Bausch & Lomb Optical Co., Rochester, N. Y. (Booth D-150)
Behr-Manning Corp., Troy, New York. (Booth C-141)
Black Drill Co., Cleveland. (Booth D-146)
Blast Furnace and Steel Plant. (Booth B-514.) See Heat Treating and Forging.
Blue Book. (Booth A-314.) See Hitchcock Publishing Co.
Brickseal Refractory Co., Hoboken, N. J. (Booth A-509)
Brickseal Refractory Co., Cleveland. (Booth A-509)
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Hard-facing is one type of welding application which conserves material.

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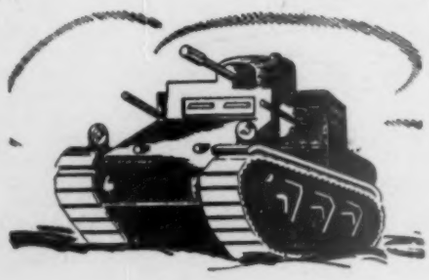


★ **TRAINING**

Official U. S. Navy Photo

Part of a "Seabee's" welding training is devoted to obtaining proficiency with the metallic arc.

Welding in the U. S. Navy

Men with experience in welding large pipe, fuel oil tanks or working with structural steel may now enlist with the "Seabees," fast-working men of the U. S. Navy's new construction regiments.

By **LT. ROGER Q. WHITE**

Ninth Naval District,
Great Lakes, Ill.

WELDORS will play an important part in the Navy program for construction of advanced fleet and air bases. Those weldors wishing to retain their civilian trade while serving with the U. S. armed forces can do no better than to enlist in the "Seabees," U. S. Navy Construction Battalions. Like most Naval units, the "Seabees" have opportunity to travel, for many battalions are now located at advance and mobile bases outside the continental limits of the United States.

Since most construction equipment must be repaired by welding (and since blacksmithing has declined in importance), it is doubly important that each Construction Battalion should have qualified weldors in its personnel. The accompanying pictures show some of the Navy weldors at work, doing both arc and oxy-acetylene welding.

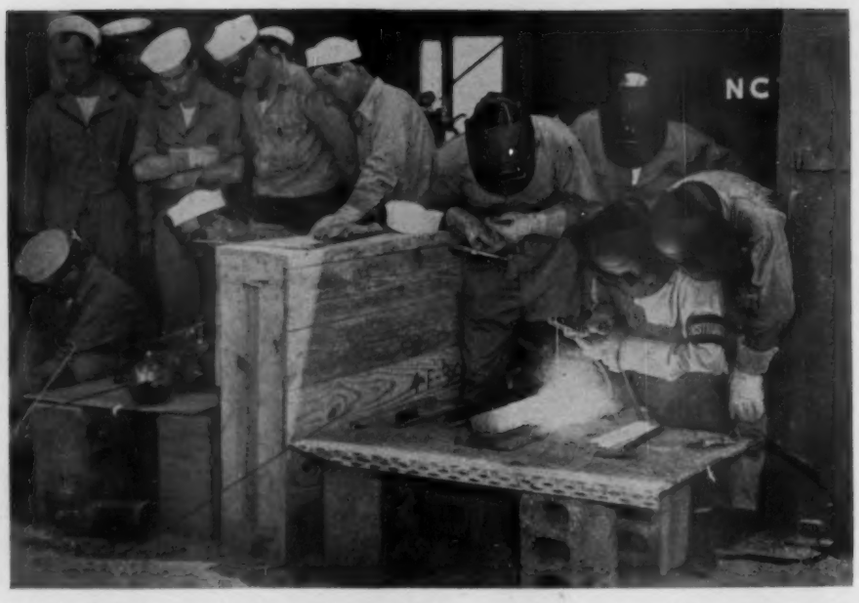
A New Branch

This new branch of the Naval service is fast expanding and will continue to do so for months to come. Its beginning was made in October, 1941, when one company of 99 men —firemen, electricians, drillers, automotive repairmen, blacksmiths and a dozen or more other trades—were banded together to build the bases so essential for successful prosecution of the war. Two months later, five additional companies were formed. These were utilized primarily as administrative units at construction projects, where work was being done by contractors with civilian labor, and their usefulness was soon made manifest.

Last December, one construction regiment of approximately 3,300 officers and men was authorized, and recruiting was under way by January, 1942. The first battalion of the first regiment started its training on January 26, 1942, one group being sent to the Naval Air Station at Quonset Point, R. I.

Qualifications

All applications for enlistment were first approved at one of the five recruiting districts with regard to the technical qualifications of the applicant. Professional qualifications corresponded to the trade of the individual applicants. Final selection included a great variety of such specialists as weldors, firemen, electricians, drillers, riggers, telephone men, truck drivers, pipe fitters,



Capable instructors train the "Seabees" until they become qualified arc and gas welders.

Official U. S. Navy Photos

Right:—Brazing of light gauge sheet metal, particularly galvanized sheet metal, is one of the important tasks to be accomplished.

painters, road machine operators, steel workers, draftsmen and laborers.

These qualified men were enrolled in Class V-6 of the Naval Reserve with ratings ranging from Seaman, second class, to Chief Petty Officer. They were given normal base pay, allowances and chances for promotion. The same regulations and opportunities exist today.

Can Fight, Too!

The "Seabees," who pave the way for Uncle Sam's sailors and marines, constitute one of the most important and necessary branches of the U. S. Navy. These men occupy and build fortifications in territories which, but for them, might have already become easy enemy stepping stones to the shores of America. They are also trained for engagement in action with the enemy when the occasion arises. In short, they are a closely knit body, under command of officers of the Civil Engineers Corps, prepared to carry out effectively all phases of construction work in potential combat zones and to resist enemy interference with their assigned tasks.

The "Seabees" are organized along military lines, companies forming regiments of three battalions. Each battalion comprises four construction companies of 226 men each and one headquarters company of 165 men composed mainly of specialists such as clerks, bakers, cooks, pharmacists, etc.

Training Stations

The men are sent from recruiting centers to Naval training stations throughout the country, where they remain for thorough training and indoctrination before being assigned to distant bases. A training station is now being erected at Norfolk, Va., to accommodate 10,000 men. There are two units of the Naval Construction Training Center at Norfolk; namely, Allen and Bradford. Allen is used for the detention period during which the men are indoctrinated in Naval discipline and customs, given a complete physical check-up and draw their outfits. Bradford is used for advance training; here the men are trained under conditions which simulate those they will find at the bases to which they will later be assigned.

The mission of these construction units is clearly outlined. Commenting on this program, Rear Admiral Ben Moreell stated, "This is a real opportunity for those two-fisted, red-blooded Americans who are not fighting behind a gun to serve shoulder to shoulder with the combatant forces of the Naval Service."

Men in our nation's armed forces may continue to read THE WELDING ENGINEER. *A special reduced price of $1.50 per year is made to them for the duration.*

These "Seabees" are constructing and welding a wire mesh road on the sand at Bradford, advanced training unit of the Naval Construction Training Center, Norfolk.

Official U. S. Navy Photo

Saving Scrap Losses Through Material Control

Fig. 10—A punch press well adapted to the manufacture of small, irregular parts from thin material. The saving in labor from punching the parts plus the saving in material from using scrap goes far towards paying for the machine in a reasonable length of time.

★

★ Part 2—Plate scrap can often be worked into standard production parts. It can also be used for building experimental units and for jigs, fixtures and dies.

By **WALTER J. BROOKING**

Director of Testing and Research, R. G. LeTourneau, Inc., Peoria

In some types of welded constructions a high percentage of the total raw material may be used in finished parts. In many other cases, however, large scrap losses can be averted only by forethought and careful planning. Part 1 of this article (September, 1942, issue of THE WELDING ENGINEER) *discussed the basic factors involved and pointed out what the engineering department and the shop steel clerk could do to insure a fuller, more efficient utilization of plate stock. In his second and concluding installment, Mr. Brooking tells how the shop processing equipment division, the tool and die department and the experimental department can also coöperate to maintain the use of materials at a high level of efficiency.*

THE PRACTICE of working up scrap of all kinds into standard production parts as soon as possible is very good economy. It saves space, material, labor and the accumulation of excess scrap materials about the plant. If space is at a premium, it is all the more important to cut scrap into usable parts soon after it is produced.

Specialized Machinery

On relatively large scale operations, the number of parts which can be taken from material which would otherwise be scrap will sometimes go a long way towards paying for a specialized machine. An example is the punch press, Fig. 10, purchase of which was justified by the parts which could be punched from small pieces of sheared or flame-cut stock, together with the other uses to which a press of this kind may be put.

The cutting of small, irregularly shaped parts from thin material is often a difficult, expensive process. If such parts are blanked on a punch press, however, they may frequently be produced at such a substantial saving that the economy of manufacture combined with the economy in material will pay the cost of the machine. Also a punch press, properly set, may often be utilized to straighten sheared parts more economically than by hammering or other hand straightening methods.

This is only one example of how scrap may be utilized for the production of parts—and of how the utilization of scrap may present a margin of economy which justifies considerable change in processing equipment and in the actual processing of the part.

Scrap for Experimental Units

Another important use for the various piles of scrap materials which have been laid aside by the steel clerk is in the manufacture of experimental machinery, jigs, fixtures, dies and other factory equipment. When an experimental unit, for instance, is being made, it is often possible that the needed material can be taken from the accumulated scrap, without having to cut into new material at all. Here, again, is the place for a steel clerk who knows his scrap pile!

Frequently, it is very good economy to make a special point of saving the end cut from such large parts as the 14 by 24 in. billet shown in Fig. 11, which has been flame-cut to

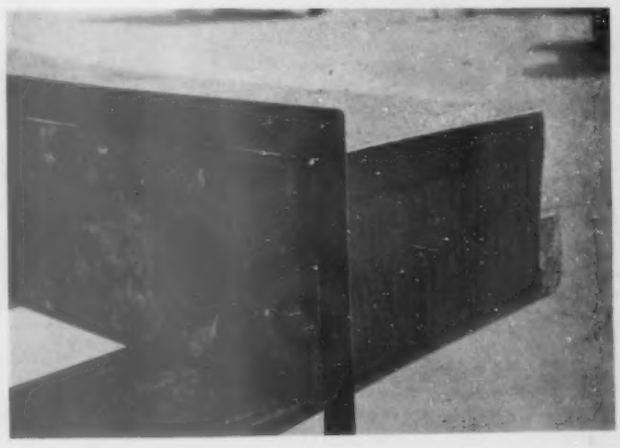


Fig. 11—End cuts from large parts often come in handy for dies, special blocks or other objects requiring large pieces of solid steel.

Fig. 12—A scrap pile of pieces ranging from 3 in. to 8 in. in thickness. These do not take up much space compared to their weight, and they supply needed die and jig material.

make a special part. The large piece left in the end cut contains considerable solid steel which can be cut into smaller parts for the manufacture of dies, lathe chucks, special blocks, etc. A scrap pile for pieces of 3 to 8 in. plate is shown in Fig. 12. Such a scrap pile often supplies very helpful pieces for special uses.

Cost Previously Charged Off

One important point to remember about such material sources is that frequently the whole weight of the raw material was charged off to the original job on the books. Hence the cost of the material for whatever else is made from the resulting scrap pieces may be accounted for at strictly scrap value.

Fig. 13 shows a group of large press dies, the material for which was taken from either heavy plate scrap, light plate scrap or bar stock scrap. Combining the use of scrap materials with modern techniques of flame-cutting, grinding, chamfering, hard-facing, etc., reduced the cost of these dies to the very minimum.

Jigs and Fixtures

The resourceful tool room foreman will also make good use of the scrap pile for the manufacture of jigs, fixtures, tool holders, etc. In Fig. 14 is a tool holder that was flame-cut from a piece of thick plate scrap. Though not a structure of beauty, the device was very economical because its material was charged to the tool room at scrap value.

Another example is the machine base shown in Fig. 15, which illustrates the advantage of having a scrap pile of angles, channels and special shapes. This base was made for a factory equipment installation in which utility was the main consideration. Every component but the two side members was from scrap plate, angles and bars. Probably it took considerably less time to get scrap sections for this structure and cut them to the correct size than would have been needed to get new sections of raw material from the steel clerk and cut the necessary parts. Yet the cost of the material for this base was only its scrap value.

This example is typical of the many opportunities to utilize scrap material for special shop equipment which may be found by the alert experimental and maintenance departments. If every opportunity is taken to use scrap for such units, the total cost of material will be reduced considerably.

THE END

Fig. 13—Scrap plate, bar and shape stock was the largest source of material used in making these press dies.

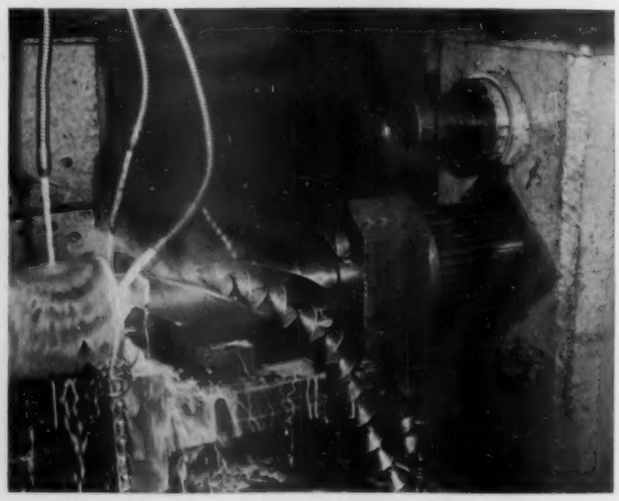


Fig. 14—When the tool room needed material to make this tool holder, the steel clerk had pieces of scrap handy.

Fig. 15—All but the side members for this shop equipment machine base were taken from the scrap boxbeam and bar stock piles. The angles were welded into box sections, flame-cut to length and then welded together to make the necessary base. Bolt holes in the plates and bars were drilled and tapped before the parts were welded together.

Flame-Cutting Speeds War Production

Salvaging of heavy-melting scrap and flame-shaping of king pins from billets are typical of new applications America is finding for oxygen and acetylene gases.

Fig. 1—Removing corner from spill with the oxygen lance.

Fig. 2—Oxygen lance in operation on a large spill. The cut in front has been completed.

Fig. 3—Spills or skulls yet to be cut. At extreme right is a heavy slag cap which will have to be removed by dynamite after lancing.

FLAME-CUTTING, flame-machining, flame-cleaning . . . almost every day brings word of the development of some new industrial application of one or another of these closely related processes. Steel mills, for example. In these days of rush war production, they must be like Old Man River and just keep "rolling along" for 24 hr or so out of every day. So it was a sad, sad story when a large mill in the Cincinnati territory experienced difficulty in obtaining sufficient scrap to keep four of its seven open-hearth furnaces in operation.

A Job for the Oxygen Lance

Oddly enough, this company had scrap in its yards — heavy-melting scrap from open-hearth spills, skulls and lost heats which had been accumulating for several years. The oxygen lance was suggested as a means of salvaging this material and, permitting a high rate of steel production to be maintained.

The oxygen lance is simply a length of clean iron or steel pipe, one end of which has been fitted with a valve for connection to an oxygen hose. A small spot on the surface of the metal to be penetrated is first pre-heated to bright red heat by means of an oxy-acetylene torch having a large size tip. Then the lance is applied to the heated area, and the oxygen valve opened. Exceedingly rapid oxidation or "burning" ensues, and this may be extended to great depth—steel 30 in. thick has been cut by this method. The end of the lance gradually burns away, its combustion yielding heat to continue the advance of the cut, and must be replaced from time to time with another length of pipe.

The steel company agreed to give oxygen lances a trial at reducing the large spills in its yards to manageable dimensions. Within a month,

Fig. 4—Splitting small spill. Note asbestos coat for the protection of the operator.

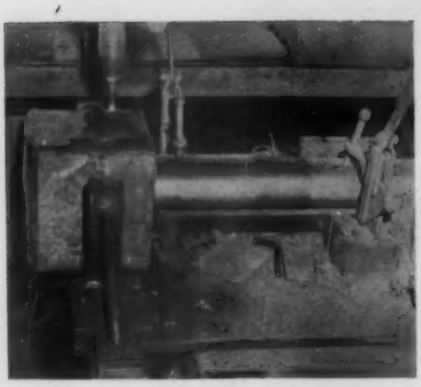


Fig. 5—Start of shape-cutting on king pin.

approximately 900 tons of scrap had been salvaged at the cost of 975,920 cu ft of oxygen. Executives of the steel mill were so pleased with results that they purchased a 20-cylinder oxygen manifold equipped with six lancing control devices and the necessary ⅜ in. oxygen hose.

Large Lances Needed

Ordinarily, pipe of ⅛, or ¼ in. diam at the most, is sufficient for oxygen lance operations. This was exceptionally heavy-duty work, however, and it was necessary to use ⅜ in. pipe. To avoid waste, the short sections of pipe remaining after lancing operations were welded to the standard 12 ft lengths.

Fig. 1 shows the removal of a corner from a spill or "chocolate drop" that had previously been cut in half.

Fig. 2 shows a larger spill, with the cut on the front completed. Slag may be seen flowing from the bottom. A few of the many spills or skulls that remain to be cut are shown in Fig. 3. At the extreme right of this picture is a spill with a heavy slag cap; such caps are blasted off with dynamite after lancing.

In Fig. 4 the oxygen lance is splitting one of the smaller size spills. The operator, it may be noted, is wearing an asbestos coat for protection against the showers of molten particles engendered by lance cutting.

Fig. 6 — Planograph-type cutting machine used for shaping king pins.

Substitute for Forgings

In an article titled, "The Cutting-Flame of Defense," THE WELDING ENGINEER, October, 1941, it was pointed out that by judicious use of flame-shaping satisfactory substitutes for forgings could be obtained from heavy slabs and billets, the individual pieces being produced in much less time than is needed for forging. Additional confirmation of the truth of this statement is now provided by the experience of a forging company, Dayton, O., district, which has found a single-torch shape-cutting machine considerable of a time-saver.

The forming of king pins from billets was formerly a machining operation, but flame-shaping of the billets is now a standard procedure, involving an oxygen consumption of 7,000 cu ft and the use of 800 cu ft of acetylene per month.

The machine used is of the planograph type, equipped with one torch and a manual tracing device. The operator follows a drawing with the tracing device, and the design is rapidly duplicated at the torch tip.

Fig. 5 shows the beginning of a shape-cutting operation on a 10 in. king pin. The complete planograph set-up, with cutting operation in progress, is illustrated in Fig. 6. The finished king pin and the road roller for which it was cut are shown in Fig. 7.

Anvils Shaped, Too

This same machine is also being used for the shape-cutting of billets for blacksmith anvils, Fig. 8. The anvils are cut in two halves which are afterwards arc welded together at a cost of 7 cents per lb as against 12 cents per lb for the former forge welding cost.

The anvil blocks range from 8 to 14 in. in thickness. The smaller cuts are made without preheating the billets, but when cutting is done on material 12 in. or thicker it is necessary to heat the pieces to approximately 500 F. Excellent results are obtained in both cases.

* * *

Acknowledgment is made to the Air Reduction Sales Co., New York City, for permission to reproduce the accompanying photographs.

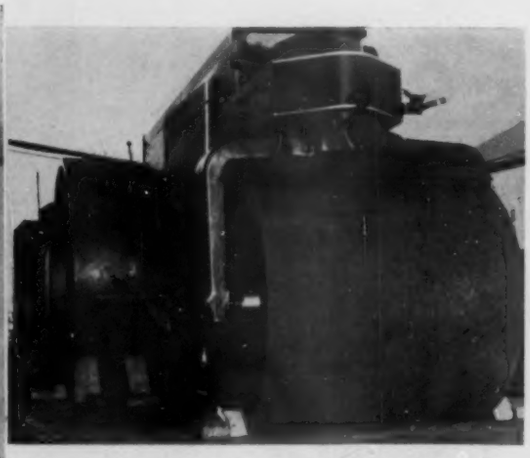


Fig. 7—The completed 10 in. king pin (left) is used as the main front end support of road roller above.

Fig. 8—Blacksmith anvils which are flame-cut and arc welded at substantial saving.

Welded Electric Furnaces

War demands in Great Britain have brought about a need for electric arc furnaces of increased size. The new furnaces are of welded construction and embody many other features. Special precautions are taken to avoid welding distortion.

By **ERIC N. SIMONS***

Fig. 1 (left)—Roller path support of a 15 ton electric arc furnace. This furnace is representative of the larger types which are now being manufactured to meet war demands for steel in Great Britain.

Fig. 2—Roller path support with rockers added. The furnace body is mounted on these 16 ft rockers, which are built up from welded plates.

THERE HAS BEEN a noticeable tendency in Great Britain for electric furnaces, particularly those of the arc type, to be of larger size in order to cope with greater output requirements. Moreover, advantage is now being taken of the possibilities of welding to solve certain problems of design and construction.

A 15 Ton Furnace

An idea of the construction of these British furnaces may be obtained from the 15 ton electric arc furnace described, which is, to some extent, pictured in the accompanying illustrations. Throughout this job, welding was profitably employed.

Fig. 1 shows the roller path support, which measures 11 ft in length, over the tracks. This is built of a center plate web, welded to a heavy base plate and a top plate. The web itself is reinforced with seven rolled steel joists, cut to suit, with gusset plates on each side.

In Fig. 2 there have been added the rockers by means of which the furnace body is tilted for pouring and charging. These rockers measure 16 ft in length by 3 ft in depth (in the center) and 2 ft 4 in. in width. Each rocker is built up from two web plates welded to top and bottom plates. Thick gusset plates were welded to the webs for reinforcements.

Guarding against Distortion

In each of the fabricated units, the utmost precaution had to be taken to prevent distortion as a result of the heat caused by welding operations. The reason why distortion cannot be tolerated will be found in the method of cradle mounting. The large roller bearing cradles are mounted between the two units and contact between the rollers. Hence, the upper and lower tracks have to be as nearly perfect as care in fabrition can make them.

Fig. 3 pictures one of the three electrode arms, assembled complete with electrode holder, copper conductors and cable terminals. The arm consists primarily of a 12 in. diam pipe, 12 ft long, to the top of which is welded a thick web plate. The latter plate is reinforced with side brackets and with angle brackets to carry the copper conductors. A sleeve about 3 ft long is welded to the pipe; after welding, the sleeve was trued in a lathe to provide a correct and true facing for the slotted clip by which the electrode arm is secured to the electrode carriage.

The units illustrated do not represent any specially intricate or difficult welding problems, but they are good examples of work which may be fabricated by welded plating, as applied to the construction of electric arc furnaces.

*Member of the British Trade Delegation to U. S. S. R. in 1929; author of "Structure of Steel," "Steel Manufacture," and other books.

Other recent advances in British electric arc furnace design include: balanced electrode gear; remote operated tightening gear for the electrode holders, which makes it unnecessary to have an operator located on the roof of the furnace when electrodes are changed; cast steel stiffeners around the top of the furnace shell and over the door openings; radial and horizontal adjustment of the electrode arms, enabling the electrode pitch circle to be changed.

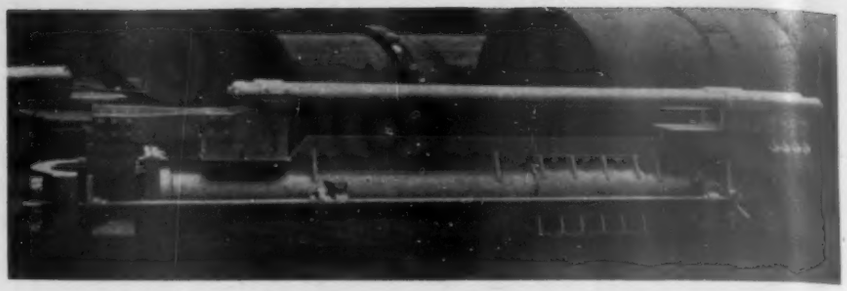


Fig. 3—This electrode arm consists primarily of a 12 in. diam pipe, 12 ft long, and is one of three such units for the furnace. It is shown here with the electrode holder, the copper conductors and cable terminals assembled.

★ ★ ★

Mechanic Builds Two Large Machines

A GOOD MECHANIC with welding equipment is able to manufacture surprisingly large and efficient machinery almost single-handed. An example is E. C. Nevitt, who operates an arc welding shop in Emporia, Kansas.

Sheep's Foot Roller

The two photographs, reproduced below through the courtesy of The Lincoln Electric Co., Cleveland, show some of Nevitt's manufactured products. One of his outstanding accomplishments was the construction of a sheep's foot roller (left picture), which is used for compacting earth during road building operations. This weird looking piece of apparatus weighs 1½ tons.

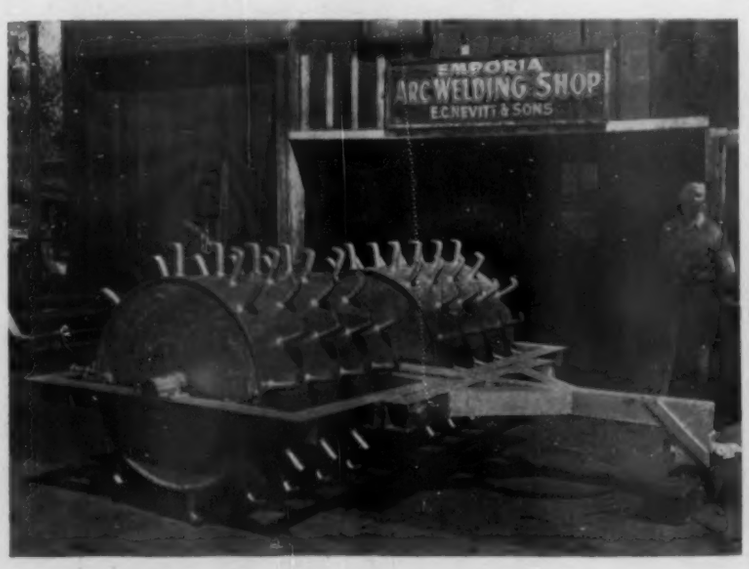
The roller was built soon after Nevitt had purchased an arc welder. The material cost about $200, and the job required the work of one man for approximately two weeks. Every joint was arc welded except for the comparatively few places where it was necessary to use bolts to permit the equipment to be dismantled for storage or shipment.

As the picture shows, the roller was made in two sections, each a heavy steel drum, 8 ft long and 40 in. in diam. The drums were welded to be absolutely water tight. Framework and tongue were made of angle steel, also arc welded.

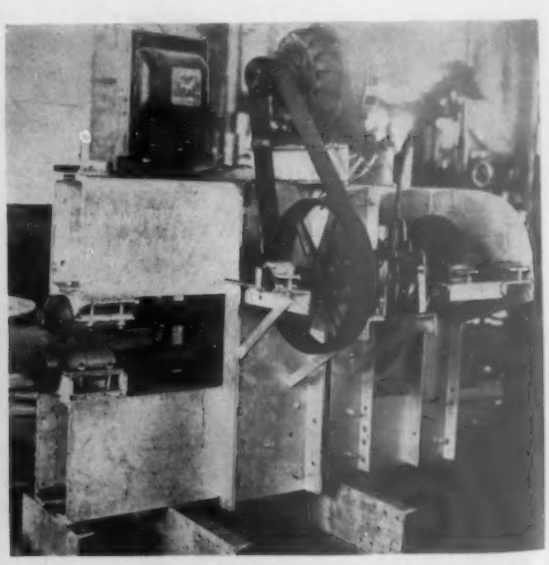
The multitudinous "feet" were made of 1¾ in. round steel, the ends of which were bent back and flattened into a surface 3 in. long by 2 in. wide. Several score of these feet were welded to the two drums with ¼ in. shielded-arc type electrodes. Each weld was made in three beads. Altogether about 200 ft of electrode material had to be used to fasten the feet down.

Shear for ¼ in. Plate

This weldor has also constructed a rotary shear (right picture), for which he has filed a patent application. This shear cuts ¼ in. boiler plate, either in a straight line or on a curve. The cutters were made from an oil well drill bit, the frame from 15 in. channel steel, and the gears were taken from a tractor. All joints, except for the bolts necessary to permit dismantling, were arc welded. The bearings also were forged and welded in Nevitt's small-scale manufacturing plant.



Sheep's foot roller for road construction.



Rotary shear for cutting ¼ in. boiler plate.

Welded Globe Valves

By H. C. ELLIOTT
Mississippi Valley Barge Line Co.

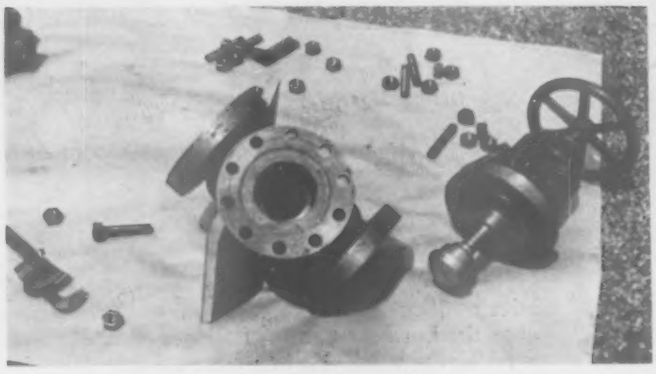


Fig. 1—The component parts of a globe valve fabricated by welding.

Lighter weight, greater strength are two of the advantages offered by the welded fabrication of globe valves. Details are given here as to how tubing, in its various sizes and thicknesses, can be used for efficient valve construction.

PRIORITIES, material shortages and insufficient production capacity because of wartime industrial activities are surely proving that "necessity is the mother of invention." On occasions these conditions have also been supplemented by the demands for a product which will be better suited for the task at hand. It was these combined conditions which led to the development of the fabricated steel globe valve.

Valves from Tubing

The fabrication of pipe line valves from tubing by welding is a radical departure from the conventional manufacturing employed in the valve-making industry. Welding has long been used as a means of joining pipes in piping installations. In many cases, welded fittings have replaced cast fittings. When it came to valves, however, those of a cast or forged type of the screwed or flanged variety have always been accepted as the unchangeable standard. But think about that for a while!

In many applications, the weight of a screwed or flanged valve is of little consequence compared with the need to have the fittings of a type that may be removed readily. In other cases, however, the weight of a cast valve is undesirable; this is particularly true in ship piping installations.[1]

Cast Valve Manufacture

Another factor against cast valves is the time required for their manufacture. The casting of globe valves has long been a time-consuming and laborious task. Cores must first be made and cured. Then molds are made and poured. Next, the casting is allowed to cool, and the gates are burned out. Finally, the casting is ground, chipped and inspected for flaws.

These invisible flaws are corrected by arc welding. In some cases, the flaws do not become apparent until the casting is in the final stages of machining—possibly when it is difficult if not impossible to salvage the piece. Thus the probability of foundry defects is one of the major difficulties encountered in the manufacture of cast valve bodies. It is especially difficult to obtain sound thin-walled castings, so wall thickness is of necessity limited by the proficiency of the foundry.

Welded Valve Advantages

The result of all this, generally, is that a valve body casting is considerably thicker (and consequently weighs more), than would be necessary merely to meet the strength and rigidity requirements of a particular installation.

In the manufacture of all sizes of valves from 2 in. up, these specific difficulties can be avoided by using

[1]See "Welded Ship Piping," page 41, September, 1942, issue of THE WELDING ENGINEER.

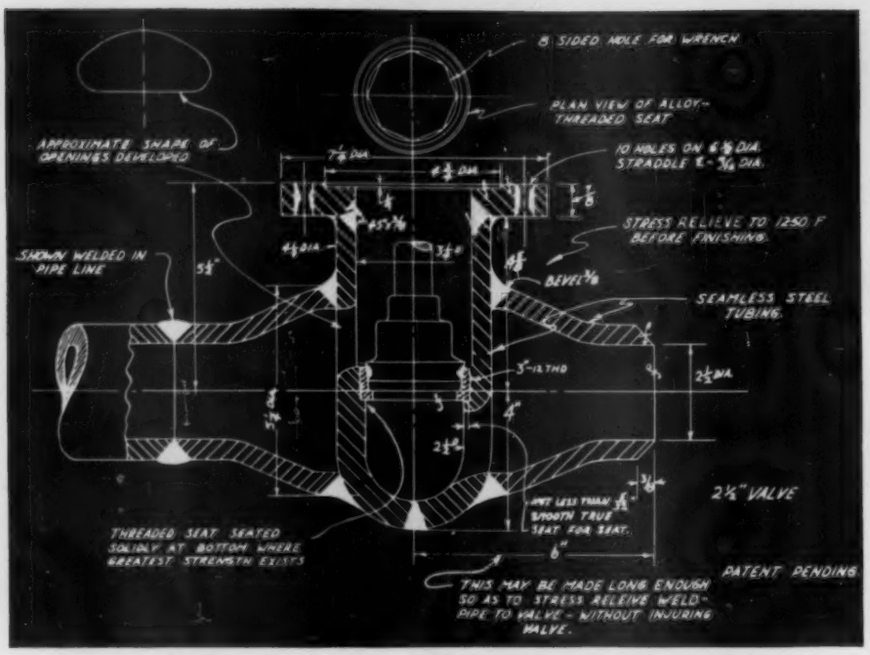

8 SIDED HOLE FOR WRENCH
PLAN VIEW OF ALLOY-THREADED SEAT
APPROXIMATE SHAPE OF OPENINGS DEVELOPED
10 HOLES ON 6⅝ DIA. STRADDLE ℄ - ⅜ DIA.
STRESS RELIEVE TO 1250 F BEFORE FINISHING
SHOWN WELDED IN PIPE LINE
BEVEL⅛
SEAMLESS STEEL TUBING
2½ DIA
2½" VALVE
THREADED SEAT SEATED SOLIDLY AT BOTTOM WHERE GREATEST STRENGTH EXISTS
THIS MAY BE MADE LONG ENOUGH SO AS TO STRESS RELEIVE WELD-PIPE TO VALVE - WITHOUT INJURING VALVE.
PATENT PENDING

Fig. 2—A drawing giving dimensions and welding details for the fabrication of globe valve bodies from tubing by use of arc welding.

welded construction; that is, by fabricating valves from tubing, bars and plates.

Welded valves can be built for all pressures, and wall thicknesses may be selected to suit the pressure requirements. There is a choice of many wall thicknesses for valves made of tubing. A 4½ in. tube, for example, is obtainable in 19 wall thicknesses varying from 16 gauge to 1⅛ in. In 5 in. tubing there are 17 different wall thicknesses varying from 11 gauge to 1 in. With such a variety of thicknesses available, it is not necessary to obtain special sizes of tubing to produce valves on a production line basis—all wall thicknesses can be selected from stock.

Tube Steel Used

For fabricating valves, a tube drawn from SAE 1035 steel (medium carbon steel) is used. SAE 1035 steel welds as nicely as any of the SAE carbon steels. A valve body made from this tubing and stress relieved after welding will almost equal the strength of a 6% chrome —0.5% molybdenum heat treated steel casting. And when compared to ordinary cast steel, SAE 1035 is far superior, as is shown in Table I.

Welded Valve Construction

Figs. 2, 3 and 4 illustrate the method of construction in the fabrication of a 2½ in. high pressure valve by the use of arc welding and steel tubing.

The first step is that of swaging a piece of 5¼ in. OD seamless tubing until its ends are 2½ in. ID. This piece of tubing will be used for the inlet and outlet openings or, in this case, the horizontal tube of the valve.

Since the vertical tube of the valve is 4¼ in. OD, the next step is to flame-cut and machine in the horizontal tube a hole large enough to receive the 4¼ in. tube.

The vertical (4¼ in. OD, ½ in. wall) is next cut to the correct length and the top layer of Monel for the seat is deposited. The tube is then turned end for end and the rest of the Monel bead run. By careful welding, this deposit can be run without pin holes and flaws irrespective of whether Monel, stainless, hard-facing, bronze or mild steel electrodes are used.

The vertical tube is now ready for the inlet and outlet slots. One opening is above the valve seat and the other below. To insure uniformity in cross-section, these slots should be laid out from templates as shown in Fig. 2. Each slot must have the same cross-sectional area as the pipe or in this case the area of cross section of a 2½ in. ID pipe. The slots are flame-cut in the tube after which they were cleaned and trimmed with an air-operated chipping hammer.

The bottom of the vertical tube may now be closed, after which the tube is inserted in the opening in the horizontal tube and welded. Inasmuch as the horizontal tube is only ⅜ in. larger in diameter than the vertical tube, the horizontal tube has just enough metal left to hold the two outlet valves together after boring through it. This small amount of metal is burned out after tacking the two tubes together. (See Section B-B, Fig. 3.)

Ready for Machining

Machining of the partly completed valve body is the next phase of the production process. The body is mounted in a lathe in such a manner

Table I—Steel Comparison Data

	SAE 1035 Tubing	Cast Steel
Tensile strength, psi	103,000	74,000
Yield point, psi	78,000	38,000
Elongation in 2 in. (%)	24	24
Reduction of area (%)	62	35

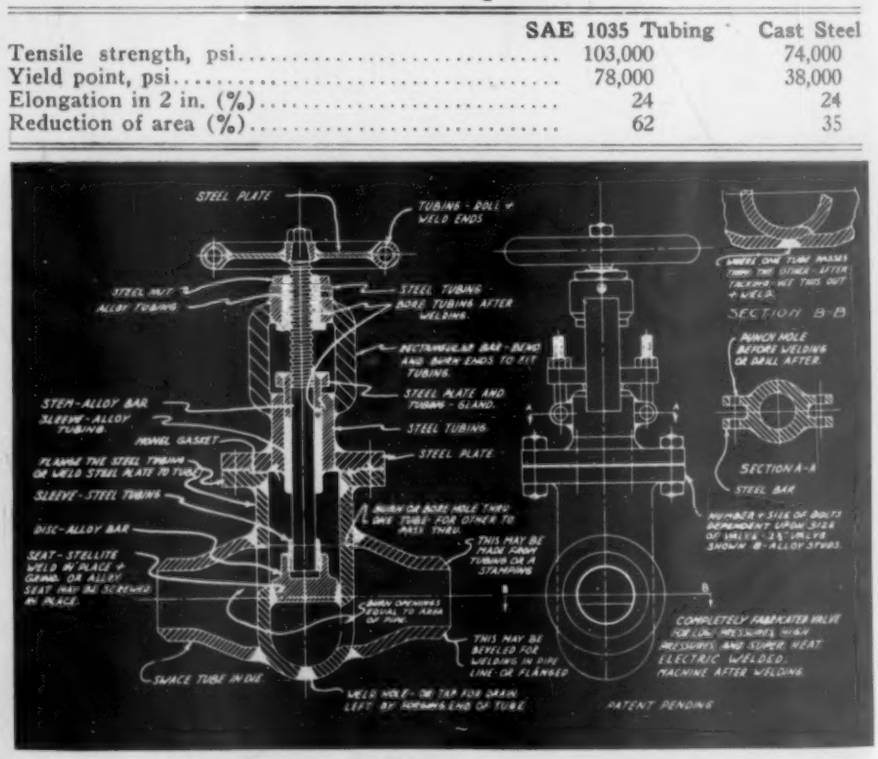

STEEL PLATE
TUBING - DRILL & WELD ENDS
STEEL NUT - ALLOY TUBING
STEEL TUBING - BORE TUBING AFTER WELDING.
RECTANGULAR BAR - BEND AND BURN ENDS TO FIT TUBING.
STEEL PLATE AND TUBING - GLAND.
STEM - ALLOY BAR
SLEEVE - ALLOY TUBING
MONEL GASKET
STEEL TUBING
STEEL PLATE
FLANGE THE STEEL TUBING OR WELD STEEL PLATE TO TUBE
SLEEVE - STEEL TUBING
DISC - ALLOY BAR
SEAT - STELLITE WELD IN PLACE & GRIND. OR ALLOY SEAT MAY BE SCREWED IN PLACE.
SWAGE TUBE IN DIE
WELD HOLE - OR TAP FOR DRAIN LEFT BY FORGING END OF TUBE
WHERE ONE TUBE PASSES THRU THE OTHER - AFTER TACKING - WE THIS OUT & WELD.
SECTION B-B
PUNCH HOLE BEFORE WELDING OR DRILL AFTER.
SECTION A-A
STEEL BAR
THIS MAY BE MADE FROM TUBING OR A STAMPING
BURN OPENINGS EQUAL TO AREA OF PIPE
THIS MAY BE BEVELED FOR WELDING IN PIPE LINE OR FLANGED
COMPLETELY FABRICATED VALVE FOR LOW PRESSURES, HIGH PRESSURES AND SUPER HEAT. ELECTRIC WELDED. MACHINE AFTER WELDING.
PATENT PENDING

Fig. 3—Details and assembly drawing of a welded steel globe valve.

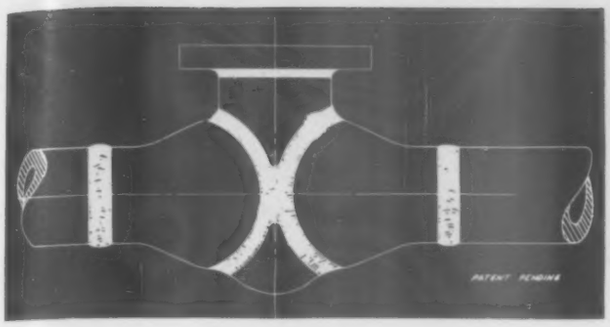


Fig. 4—A welded valve may be welded into the pipe line quite readily. In this event flanges are omitted.

as to permit the facing and chamfering of the top of the vertical and the ends of the horizontal tube for subsequent welding operations. Next, top plate and flanges were welded on. This rendered the body ready for final machining, which consisted of the following operations: (a) facing flanges; (b) truing inside welds; (c) machining seat to proper angle; (d) drilling bolt holes.

The bonnet of the valve is welded in a simple fixture which aligns the tubing, plates and bars in their correct positions while being tacked and while final beads are run. No preliminary machining is required for the bonnet parts. The assembled bonnet is chucked only once; that is, for final facing of the bottom flange, boring of the two pieces of tubing, and facing the tubing at three places.

One piece of tubing with a plate welded to one end and machined to fit makes up the packing gland. The valve stem guide is made of stainless steel tubing and is held in place by a light weld bead of Monel. The valve stem and disc are Monel—both of conventional design.

Saves Weight and Money

The welded valve offers a real saving. Using the same rates of labor costs and overhead figures, a welded valve can be built for 52% less than a cast steel valve. A cast steel valve (standard 2½ in.) weighs 200 lb while a similar valve of welded steel weighs only 100 lb. Also, this 2½ in. welded globe valve of this design is good for a working pressure of 1,500 psi and a total temperature of 750 F. It has been tested by hydraulic pressure to 5,500 psi.

The American Bureau of Shipping has approved this design as practical for valves for steam power plant equipment aboard ship. A patent is pending on the method of construction and design.

Fig. 5 — A 2½ in. globe valve of the all-welded type.

* * *

Photographs and drawings, courtesy of Hobart Brothers, Troy, Ohio.

Cleaning Tank from Scrap

SAVING MAN-HOURS and metal is a mighty important contribution to war effort. By using the metal from a scrap pile and his arc welder to construct it into a useful tank, W. R. Tierce, welding operator for the Illinois Pipe Line Co., saved 128 man-hours with his fast, new method for cleaning pipe line connections.

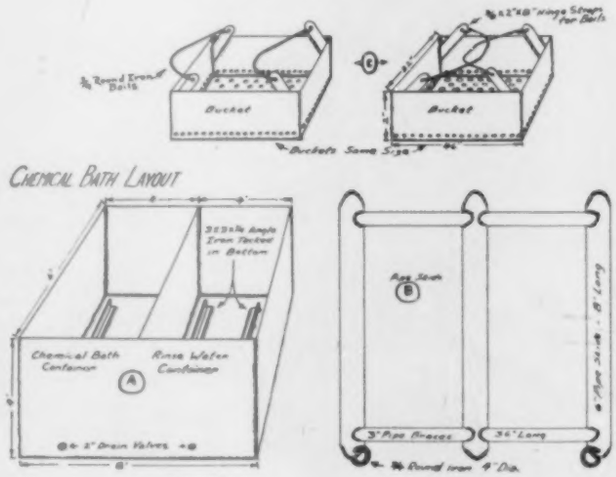
The former method of cleaning connections was to clean them with a wire brush with either gasoline or kerosene. Now maintenance men use a chemical bath, which cuts down cleaning time tremendously. The connections are placed in the dipping buckets (shown in the drawing) and from there go into the chemical bath section of the cleaning tank ("A" in drawing). A fire is lighted under the tank, and the connections left to boil for five hours.

After the fire is out, the bucket is withdrawn from the bath, given time to drain, and plunged five or six times into the rinse section of the tank. When cool, a few passes with a wire brush will clean connections.

All metal for the dip tank and dipping buckets was taken from the company's scrap pile. The tank was constructed by welding sections of old ⅛ in. flat tank bottom sheets. Bucket guides and rests on the bottom of the tank were made from 3 in. by 3 in. by ¼ in. angle iron. A 2 in. drain valve drains each compartment. Tank skids were made from 6 in. and 3 in. pipe.

The dipping buckets were also constructed by welding ⅛ in. tank bottom sheets. Bails were made from ¾ in. round iron scrap; hinge straps from ⅜ in. by 2 in. by 8 in. iron. Holes were drilled into bucket bottom for draining.

This bucket and dip tank cost only $46.22 to construct, including materials, labor and overhead. For comparison, the company cleaned the same amount of connections by both methods. Cleaning by wire brush and kerosene took four men six days time or 192 hours. Cleaning with the welded chemical dip tank took four men two days or 64 hours. A single application of the new cleaning process paid for its construction.



Scrap sheets and pipe were used advantageously in the building of a cleaning tank which greatly reduced the cleaning time needed prior to welding.

Courtesy Hobart Brothers

Conserving Tool Steel

Tool steel is vital to the war effort and so is growing scarcer all the time for civilian users. But even hard steel rolls wear down and must be replaced—unless some other way can be found.

By **EDWARD L. QUINN**
Manager, Welding Products Dept., American Manganese Steel Div. of American Brake Shoe & Foundry Co.

Fig. 1—Shingle cutting machine. Roll roofing is in foreground, strips cut from roll in back.

THE UNANIMITY with which American industry is coöperating in the critical materials conservation program is manifested by the efforts of a number of composition roofing manufacturers to conserve vital tool steel.

Composition shingles are manufactured from roll roofing paper, which is fed through the machine illustrated in Fig. 1. The roofing paper passes between anvil rolls and rotary knives which cut the design in the roll. On the particular machine shown a small strip is cut at intervals from several places across the 40 in. wide rolls, giving the appearance of shingles when the rolls are divided or partitioned.

The gravel (silica quartz) used on the weather-side of the roofing paper is highly abrasive and has a pronounced wearing action on the anvil rolls, augmented by the pressure of the knives. It was formerly considered impossible to use anything but tool steel for these rolls. Now, however, several mills have changed over to 0.35% to 0.45% carbon steel anvil rolls, applying a manganese base electrode for tool welding to that portion of the ring subjected to extreme abrasion.

These composite die rings are said to be highly satisfactory—and a lot more economical than the tool steel rolls formerly used. When rolls have become worn, they are restored with hard-facing. Many tool steel die rings are still in use, however, and these likewise are being salvaged when they become worn by the application of new metal to the "cutting band."

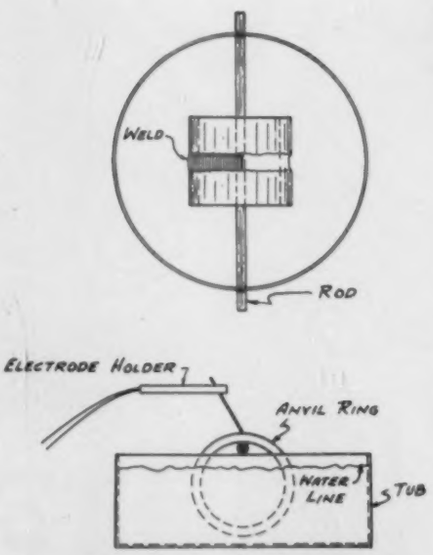


Fig. 2—Method of applying hard-facing to the anvil ring. The water is necessary to prevent undue heating of the tool steel roll, which might cause warpage.

Method of Application

When repairs are made, a roll is suspended on a rod in a tank of water (shown in Fig. 2). Water is necessary because tool steel rolls are ground to close tolerances and any undue heating might cause warpage to occur. After a small amount of weld metal has been deposited, the roll is turned so that the deposit is submerged. There is a continuous flow of water through the tank to maintain an even temperature.

Fig. 3—Anvil rolls as welded (left) and ground.

A portion of the ring is left protruding above the water at all times. This serves to provide adequate preheat from the radiation of the weld area to prevent cracking of the tool steel ring.

Fig. 3 shows anvil rolls as welded and ground. This application, it should be stated, is only one instance of how the hard-facing process is saving important metals for America's war needs.

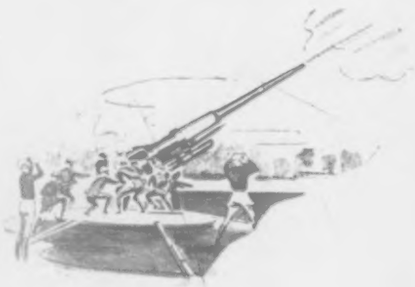
Weldable Alloy Materials

Ferrous and Non-Ferrous

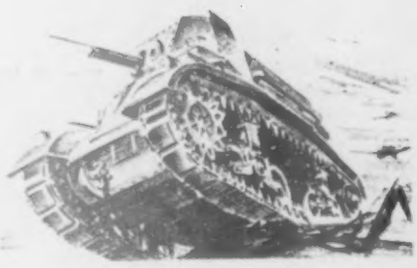
(A Survey)

(Second Edition)

T. B. JEFFERSON
Editor



Materials are scarce! Available materials must be made to go as far as possible, and the substitutes must be used. It is so that you, the fabricator of welded products might be able to substitute materials having similar chemical, mechanical and welding properties for those materials you are unable to obtain, that this survey was made.



Weldable Alloy Materials

The need for information as to the welding qualities of ferrous and non-ferrous materials is increasing. This information, together with chemical and mechanical properties of 301 alloy materials is given on the following pages.

MATERIALS are getting more scarce, yet at the same time there is a constant demand for stronger and lighter fabrication. Alloys, both ferrous and non-ferrous, are in demand and frequently substitutes are called into use, too.

Soon the standard substitute in the ferrous group will be the NE steels but until production is begun on National Emergency Steels the most available substitute will have to be used. Substitutes frequently demand a special welding technique because of "tricky" reactions, when subjected to heat. Naturally, under such conditions, there is a tendency by a fabricator to question the advisability of welding any alloy material which he has not previously welded or which he knows is weldable.

In these days of substitutes, when it is often impossible to obtain the "old standby" alloy, many questions arise. Can "substitute" alloy be welded? Who makes it? What are its normal chemical properties? Mechanical properties? In what other shapes can it be obtained? So that the reader of THE WELDING ENGINEER might have all this information at his finger tips, a survey was made and the results are published on the following pages.

In this survey questionnaires were sent to every known producer of alloy material in the United States. So that the final results would be of greatest value to those in the welding industry, only those alloy producers making sheets and plates were considered eligible for listing. Such limitation naturally prevented the listing of many alloys but it is felt that those in the welding industry are primarily interested in welding alloy sheets and plates. Of course, if a manufacturer produces alloys in sheets and plates and also in other forms, practically all of the available forms have been listed in the tabular results of this survey.

The chemical composition of the various alloys listed must not be considered as exact. They are the nominal or approximate percentages and may vary within the practical limits which will not materially affect the other qualities of the material. It should be noted that in many alloys, particularly the ferrous alloys, that phosphorous and sulphur is not necessarily considered as an impurity. These two elements are frequently added to the alloy to improve its machining qualities, etc., thus accounting for their presence in seemingly high percentages in some alloys.

It should be noted that many of the various types of stainless steels are produced by most of the major steel producing companies, while several of the copper alloys are common to the three listed producers of these materials.

The various clad alloy materials have also been included in this survey. The stainless clads are listed among the weldable ferrous alloys and the nickel and related clads are in the non-ferrous listings. In either case, the chemical composition, mechanical and welding properties which are given refer only to the clad material. Inasmuch as these clads are usually bonded to a mild steel plate, little difficulty is encountered in welding the mild steel plate, so naturally those references made to welding properties are those of the clad alloys.

The mechanical properties of welded strength, tensile strength and ductility are also only the nominal figures. In most cases it can be assumed that the figures given are the minimum expected results. These mechanical properties frequently range between wide limits because of various processing operations, such as heat treatment, hot or cold working, annealing, etc.

Under the heading of Welding Qualities it will be noted that only the arc, gas and resistance processes of welding have been considered as these three processes are the only fusion welding processes practical for joining sheets and plates. Unless it is otherwise noted, it should be considered, in these tabulations, that arc welding refers only to the metallic arc welding process. Many of the alloy materials listed are also weldable by other arc welding process; e.g., atomic hydrogen, carbon, or submerged melt (Unionmelt) processes, but since the use of these processes and information regarding their results when welding alloys are limited, they were not considered in this survey.

In the case of many of the alloy materials available, they are weldable only if certain conditions are met. Most of these conditions are summarized briefly in the footnotes accompanying the tabular listings. If any doubt exists after having noted the requirements which, as outlined in the footnotes, must be fulfilled to successfully weld a given alloy, it is recommended that the producer of the material be consulted.

WELDABLE ALLOY MATERIALS—FERROUS

No.	Material	Manufacturer	Nominal Chemical Composition (Percent)	Yield Stgth. * 1,000 psi	Tensile Stgth. ** 1,000 psi	Elongation % in 2 in.	Forms Available†	Welding Qualities‡‡			No.
								Arc	Gas	Resistance	
1	AISI 4608	U.S. Steel Corp., Pittsburgh, Pa.	S. .040 max.; P. .040 max.; C. .06-.11; Mn. .40; Si. .25 max.; Ni. 1.40-1.75; Mo. .15-.25.	t	t	t	S, CR.	A	D	D	1
2	AISI A-2330	U.S. Steel Corp., Pittsburgh, Pa.	S. .040 max.; P. .040 max.; C .28-.33; Mn. .60-.80; Si. .20-.35; Ni. 3.25-3.75.	u	u	u	S, P, B.	B[1]	D	D	2
3	AISI A-4142	U.S. Steel Corp., Pittsburgh, Pa.	S. .040 max.; P. .040 max.; C. .40-.45; Mn. .75-1.00; Si. .20-.35; Cr. .80-1.10; Mo. .15-.25.	u	u	u	P, B.	B[1]	D	B[2]	3
4	AISI E-4337	U.S. Steel Corp., Pittsburgh, Pa.	S. .025 max.; P. .025 max.; C. .35-.40; Mn. .60-.80; Si. .20-.35; Ni. 1.65-2.00; Cr. .70-.90; Mo. .23-.30	u	u	u	P.	B[1]	D	D	4
5	ASTM A-203 Grade A(a)	U. S. Steel Corp., Pittsburgh, Pa.	S. .040 max.; P. .035 max.; C .17 max.; Mn. .80 max.; Si. .15-.30; Ni. 2.00-2.75	.55% T.S.	65-77	v	P.	B[1]	D	D	5
6	ASTM A-203 Grade B(a)	U.S. Steel Corp., Pittsburgh, Pa.‡	S. .040 max.; P. .035 max.; C. .20 max.; Mn. .80 max.; Si. .15-.30; Ni. 2.00-2.75	.55% T.S.	70-82	v	P.	B[1]	D	D	6
7	ASTM A-203 Grade C(a)	U.S. Steel Corp., Pittsburgh, Pa.	S. .040 max.; P. .035 max.; C. .25 max.; Mn. .80 max.; Si. .15-.30; Ni. 2.00-2.75	.55% T.S.	75-87	v	P.	B[1]	D	D	7
8	ASTM A-204 Grade A(b)	U.S. Steel Corp., Pittsburgh, Pa.	S. .040 max.; P. .035 max.; C. .18-.25 max.; Mn. .50-.90; Si. .15-.30; Mo. .40-.60.	.55% T.S.	65-77	w	P, B.	B[1]	D	D	8
9	ASTM A-204 Grade B(b)	U.S. Steel Corp., Pittsburgh, Pa.	S. .040 max.; P. .035 max.; C. .20-.27 max.; Mn. .50-.90; Si. .15-.30; Mo. .40-.60.	.55% T.S.	70-82	w	P, B.	B[1]	D	D	9
10	ASTM A-204 Grade C(b)	U.S. Steel Corp., Pittsburgh, Pa.	S. .040 max.; P. .035 max.; C. .23-.28 max.; Mn. .50-.90; Si. .15-.30; Mo. .40-.60.	.55% T.S.	75-87	w	P, B.	B[1]	D	D	10
11	ASTM A-225-39 Grade A(c)	U.S. Steel Corp., Pittsburgh, Pa.‡	S. .040 max.; P. .035 max.; C. .18 max.; Mn. 1.45 max.; Si. .15-.30; V. .08-.14.	.55% T.S.	70-82	w	P.	A	D	D	11

*Yield strength is that load which will produce an elongation of .002" in 1". The value is obtained from stress-strain curves, and is based on a 29,000,000 psi Modulus of Elasticity for steel, 6,500,000 psi for magnesium alloys, 10,300,000 psi for aluminum, 15,000,000 psi for brasses, 20,000,000 psi for 70/30 cupro-nickel.

**Single figure (50) indicates minimum value. Double figures (28-50) indicate range, which varies because of production processes or other causes; e.g., heat treatment, annealing, cold rolling, drawing, etc.

†Available forms: P=plates, S=sheets, CR=cold rolled, HR=hot rolled, B=bars, W=wire, T=tubing, R=rods.

‡‡Welding Qualities: A=Readily weldable. B=Weldable under favorable conditions (see footnotes). C=Not ordinarily weldable. D=No welding data available.

‡Also available from Alan Wood Steel Co., Conshohocken, Pa.

a. Nickel Steel to A.S.T.M. Specs., b. Carbon Moly to A.S.T.M. Specs., c. Manganese Vanadium to A.S.T.M. Specs.

t. Used as furnished. u. Usually heat treated. v. 1,650,000/T. S. w. 1,750,000/T. S.

1. The necessity for stress relief annealing usually depends on the character of part and service. Adequate preheat can confer practically the same metallurgical advantages as post heating. 2. Can be flash welded.

WELDABLE ALLOY MATERIALS—FERROUS

No.	Material	Manufacturer	Nominal Chemical Composition (Percent)	Yield Stgth.* 1,000 psi	Tensile Stgth. ** 1,000 psi	Elongation % in 2 in.	Forms Available†	Welding Qualities‡‡			No.
								Arc	Gas	Resistance	
12	ASTM A-225-39 Grade B(c)	U.S. Steel Corp., Pittsburgh, Pa.	S. .040 max.; P. .035 max.; C. .20 max.; Mn. 1.45 max.; Si. .15-.30; V. .08-.14.	.55% T.S.	75-87	w	P.	A	D	D	12
13	A.W. Dyn-El	Alan Wood Steel Co., Conshohocken, Pa.	C. .12; Mn. .60; P. .085; Cu. .40.	50	72	28	S, P.	A	A	A	13
14	Abrasion Resisting	Lukens Steel Co. Coatesville, Pa.‡	S. 0.34; P. .030; C. .43; Mn. 1.80; Si. .27	75	120	21	S, P.	B[3]	B[3]	D	14
15	Allegheny Metal 17-7	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	C. .09-.20; Mn. 1.25 max.; Ni. 7-9 Cr. 16-18	40	100	50	S, CR, B, W.	A	X	A	15
16	Allegheny Metal 18-8	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	C. .08-.20; Mn. 1.25 max.; Ni. 8-10; Cr. 17.5-20.0	35	80	50	S, P, CR, B, W, T, C.	A	X	A	16
17	Allegheny Metal 18-8-S	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	C. .08 max; Mn. 2.0 max; Ni. 8-10; Cr. 18-20	30	75	50	S, P, CR, HR, B, W, T, C.	A	X	A	17
18	Allegheny Metal 20-10-S	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	C. .08-max.; Mn. 2.0 max.; Ni. 10-12; Cr. 19-22	30	80	50	S, P, CR, HR, B, W, T, C.	A	X	A	18
19	Allegheny Metal 25-12	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	C. .20 max.; Ni. 12-14; Cr. 22-26	35	80	50	S, P, CR, B, W, C.	A	X	A	19
20	Allegheny Metal 25-12S	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	C. .08 max.; Ni. 12-14; Cr. 22-26	35	80	50	S, P, CR, B, W, C.	A	X	A	20
21	Allegheny Metal 25-20	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	C. .25 max.; Ni. 19-21; Cr. 24-26	35	80	50	S, P, CR, B, W, T, C.	A	X	A	21
22	Allegheny Metal 18-8-M	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	C. .10 max.; Ni. 10-14; Cr. 16-18; Mo. 2-3	35	80	50	S, P, CR, B, W, T, C.	A	X	A	22
23	Allegheny Metal 18-8-M Spec.	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	C. .10 max; Ni. 10-14; Cr. 18-20; Mo. 3-4	35	80		S, P, CR, B, W, T, C.	A	X	A	23
24	Allegheny Metal 18-8-T	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	C. .10 max; Ni. 7-10; Cr. 17-20; Ti. 4xC. Min.	35	75	50	S, P, CR, B, W, T, C.	A	X	A	24
25	Allegheny Metal 18-8-C	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	C. .10 max.; Ni. 8-12; Cr. 17-20; Cb. 10 x C.	35	75	50	S, P, CR, B, W, T, C.	A	X	A	25
26	Allegheny Metal 12-NH	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	C. .08 max.; Cr. 11.5-13.5; Al. .10-.20	35	60	25	S, P, CR, B, W, T.	A	X	B[4]	26
27	Allegheny Metal 12	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	S. .025 max.; P. .025 max.; C. .15 max.; Mn. .50 max.; Si. .50 max.; Cr. 11.5-13.5	35	60	25	S, P, CR, B, W, T.	A	X	B[4]	27
28	Allegheny Metal 17	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	S. .025 max.; P. .025 max.; C. .12 max.; Mn. .50 max.; Si. .50 max.; Cr. 16-18	35	60	30	S, P, CR, B, W. T.	A	X	B[4]	28
29	Allegheny Metal 21	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	C. .35 max.; Cr. 18-23	40	65	28	S, P, B, W.	A	X	B[4]	29
30	Allegheny Metal 28	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	C. .35 max.; Cr. 23-30	45	75	20	S, P, CR, B, W, T.	A	X	B[4]	30
31	Allegheny Metal 46 Type 501.	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	C. over .10; Cr. 4-6	40	70	25	S, P, B, W.	A	X	B[4]	31
32	Allegheny Metal 46 Type 502.	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	C. .10 max.; Cr. 4-6	35	60	30	S, P, B, W, T.	A	X	B[4]	32

No.	Material	Manufacturer	Nominal Chemical Composition (Percent)	Yield Stgth. * 1,000 psi	Tensile Stgth. ** 1,000 psi	Elongation % in 2 in.	Forms Available†	Welding Qualities‡‡			No.
								Arc	Gas	Resistance	
33	Allegheny Pluramelt	Allegheny Ludlum Steel Co., Pittsburgh, Pa.	Carbon steel bonded integrally on one or both sides with many of the above stainless steels.				S, P.	A	C	B[5]	33
34	Armco Chromsteel	American Rolling Mill Co., Middletown, Ohio.	S. min.; P. min.; C. 0.06; Mn. 0.75; Si. 0.40; Cr. 11.5;	55	80	25	S, P.	B[6]	B[6]	B[6]	34
35	Armco Galv. Ingot Iron	American Rolling Mill Co., Middletown, Ohio	S. .025; P. .005; C. .015; Mn. .035; Si. .003	30	45	35	S, P.	A	A	A	35
36	Armco Galvanized C-B Steel	American Rolling Mill Co., Middletown, Ohio.	S. .030; P. .008; C. .070; Mn. .360; Si. .003; Cu. .20 min.	30	45	29	S, P.	A	A	A	36
37	Armco Galvanized O-H Steel	American Rolling Mill Co., Middletown, Ohio.	S. .030; P. .008; C. .070; Mn. .360; Si. .003	30	45	32	S, P.	A	A	A	37
38	Armco Hot & Cold Rolled	American Rolling Mill Co., Middletown, Ohio.	P. .008-.025; C. .04-.08; Mn. .20-.50; Cu. as specified	28-85	45-85	40-4	S, P.	A	A	A	38
39	Armco High Tensile	American Rolling Mill Co., Middletown, Ohio.	S. .030; P. .10; C. .10; Mn. .45; Si. .08; Ni. .75; Cu. .60; Mo. .10	50 min.	65-75	28-25	S, P.	A	A	A	39
40	Armco Ingot Iron	American Rolling Mill Co., Middletown, Ohio.	S. .025; P. .005; C. .015; Mn. .035; Si. .003	30	45	35	S, P.	A	A	A	40
41	Armco Long Terne Sheets	American Rolling Mill Co., Middletown, Ohio.		26-57	30-45	26-44	S, P.	A	A	B	41
42	Armco Paintgrip Ingot Iron	American Rolling Mill Co., Middletown, Ohio	S. .025; P. .005; C. .015; Mn. .035; Si. .003	30	45	35	S, P.	A	A	B	42
43	Armco Paintgrip Copper Bearing Steel.	American Rolling Mill Co., Middletown, Ohio.	S. .030; P. .008; C. .070; Mn. .360; Si. .003; Cu. .20 min.	30	45	29	S, P.	A	A	B	43
44	Armco Paintgrip O. H. Steel	American Rolling Mill Co., Middletown, Ohio.	S. .030; P. .008; C. .070; Mn. .360; Si. .003	30	45	32	S, P.	A	A	A	44
45	Armco Stainless Steel 17-7	American Rolling Mill Co., Middletown, Ohio.	S. .03 max.; P. .03 max.; C. .09-.20; Mn. .65; Si. .45; Ni. 7-9; Cr. 16-18;	45	90	55	S, P.	A	A	A	45
46	Armco Stainless Steel 18-8 Type 302	American Rolling Mill Co., Middletown, Ohio.	S. .03 max.; P. .03 max.; C. over .08-.20; Mn. 1.25 max.; Si. .30-.60; Ni. 8-10; Cr. 18-20	45	90	55-60	S, P.	A	A	A	46

*Yield strength is that load which will produce an elongation of .002″ in 1″. The value is obtained from stress-strain curves, and is based on a 29,000,000 psi Modulus of Elasticity for steel, 6,500,000 psi for magnesium alloys, 10,300,000 psi for aluminum, 15,000,000 psi for brasses, 20,000,000 psi for 70/30 cupro-nickel.

**Single figure (50) indicates minimum value. Double figures (28-50) indicate range, which varies because of production processes or other causes; e.g., heat treatment, annealing, cold rolling, drawing, etc.

†Available forms: P = plates, S = sheets, CR = cold rolled, HR = hot rolled, B = bars, W = wire, T = tubing, R = rods.

‡‡Welding Qualities: A = Readily weldable. B = Weldable under favorable conditions (see footnotes). C = Not ordinarily weldable. D = No welding data available. X = This method of gas welding may be applied successfully to the chromium nickel and straight chromium alloys under certain conditions, but it is not as well adapted for general work with these alloys as is the metallic arc method. It is frequently employed on 20 gauge and lighter material.

‡Also available from Alan Wood Steel Co., Conshohocken, Pa.

c. Manganese Vanadium to A.S.T.M. Specs.,

w. 1,750,000/T. S.

1. The necessity for stress relief annealing usually depends on the character of part and service. Adequate preheat can confer practically the same metallurgical advantages as post heating. 2. Can be flash welded. 3. Preheat during welding is required; the temperature during welding should be suitable for the composition and thickness of the material. Special welding technique required also. 4. Annealing suggested to remove brittleness and to improve ductility. 5. Thin sections. 6. Post heat.

No.	Material	Manufacturer	Nominal Chemical Composition (Percent)	Yield Stgth.* 1,000 psi	Tensile Stgth. ** 1,000 psi	Elongation % in 2 in.	Forms Available†	Welding Qualities‡‡			No.
								Arc	Gas	Resistance	
47	Armco Stainless Steel 18-8, Type 304	American Rolling Mill Co., Middletown, Ohio.	S. .03 max.; P. .03 max.; C. .08 max.; Mn. 2.00 max.; Si. .30-.60; Ni. 8-10; Cr. 18-20	40	85	60-65	S, P.	A	A	A	47
48	Armco Stainless Steel 25-12	American Rolling Mill Co., Middletown, Ohio.	S. .03 max.; P. .03 max.; C. .20 max.; Mn. 1.25; Si. .90; Ni. 12-14; Cr. 22-26	45	95	45	S, P.	A	A	A	48
49	Armco Stainless Steel 18-12 Mo.	American Rolling Mill Co., Middletown, Ohio.	S. .03 max.; P. .03 max.; C. .10 max; Mn. 2.00 max.; Si. .30-.60; Ni 14 max.; Cr. 16-18; Mo. 2-3	40	85	45-55	S, P.	A	A	A	49
50	Armco Stainless Steel 19-12 Mo.	American Rolling Mill Co., Middletown, Ohio.	S. .03 max.; P. .03 max.; C. .10 max.; Mn. 2.00 max.; Si. .30-.60; Ni. 14 max; Cr. 18-20; Mo. 3-4	40	85	40-50	S, P.	A	A	A	50
51	Armco Stainless Steel 18-10 Ch.	American Rolling Mill Co., Middletown, Ohio.	S. .03 max.; P. .03 max.; C. .10 max.; Mn. 1.50 max.; Si. .75 max.; Ni. 8-12; Cr. 17-20; Cb. min. 10x carbon	40	85	45-55	S, P.	A	A	D	51
52	Armco Stainless Steel 27	American Rolling Mill Co., Middletown, Ohio.	S. .03 max.; P. .03 max.; C. .35 max.; Mn. .80 max.; Si. 1.00; Cr. 23-30	50	80	23	S, P.	B[4]	B[7]	B[4]	52
53	Armco Stainless Steel 17	American Rolling Mill Co., Middletown, Ohio.	S. .03 max.; P. .03 max.; C. .12 max.; Mn. .30-.60; Si. .50; Cr. 14-18	45	75	27	S, P.	B[4]	B[7]	B[4]	53
54	Armco Stainless Steel 13	American Rolling Mill Co., Middletown, Ohio.	S. .03 max.; P. .03 max.; C. .15 max.; Mn. .45; Si. .45; Cr. 10-14	35	65	30	S, P.	B[4]	B[4]	B[4]	54
55	Armco Zincgrip Ingot Iron	American Rolling Mill Co., Middletown, Ohio.	S. .025; P. .005; C. .015; Mn. .035; Si. .003	40	55	28	S, P.	A	A	A	55
56	Armco Zincgrip Copper Bearing Steel	American Rolling Mill Co., Middletown, Ohio.	S. .030; P. .008; C. .070; Mn. .360; Si. .003; Cu. .20 min.	45	60	28	S, P.	A	A	A	56
57	Armco Zincgrip O. H. Steel	American Rolling Mill Co., Middletown, Ohio.	S. .030; P. .008; C. .070; Mn. .360; Si. .003	45	60	30	S, P.	A	A	A	57
58	Armco Zincgrip-Paintgrip Ingot Iron	American Rolling Mill Co., Middletown, Ohio.	S. .025; P. .005; C. .015; Mn. .035; Si. .003	40	55	28	S, P.	A	A	A	58
59	Armco Zincgrip-Paintgrip Cu. Bear. Steel	American Rolling Mill Co., Middletown, Ohio.	S. .030; P. .008; C. .070; Mn. .360; Si. .003; Cu. .20 min.	45	60	28	S, P.	A	A	A	59
60	Armco Zincgrip-Paintgrip O. H. Steel	American Rolling Mill Co., Middletown, Ohio.	S. .030; P. .008; C. .070; Mn. .360; Si. .003	45	60	30	S, P.	A	A	A	60
61	"Band Hack"	Henry Disston & Sons, Tacony, Phila., Pa.	S. .025; P. .025; C. 1.25-1.32; Mn. .10-.25; Si. .10-.20; Cr. .10-.20	124.1	151.1	9.5	S, P, CR, HR, B.	B[8]	B[8]	B[8]	61
62	"Best Tool"	Henry Disston & Sons, Tacony, Phila., Pa.	S. .025; P. .025; C. .80-1.; Mn. .20-.40; Si. .15-.30; Ni. .10 max.; Cr. .10 max.	174	193.6	7	S, P, CR, B.	A	A	A	62
63	Carbon Molybdenum A-204-A	Lukens Steel Co., Coatesville, Pa.	S. .019; P. .019; C. .15; Mn. .80, Si. .22; Mo. .46	42	68	35	P	A	A	A	63
64	Carbon Molybdenum A-204-B	Lukens Steel Co., Coatesville, Pa.	S. .021; P. .018; C. .18; Mn. .83; Si. .20; Mo. .50	46	75	33	P	B[9]	B[9]	B[9]	64
65	Carbon Molybdenum A-204-C	Lukens Steel Co., Coatesville, Pa.	S. .025; P. .016; C. .20; Mn. .80; Si. .19; Mo. .52	54	81	28	P	B[10]	B[10]	B[10]	65

No.	Material	Manufacturer	Nominal Chemical Composition (Percent)	Yield Stgth. * 1,000 psi	Tensile Stgth. ** 1,000 psi	Elongation % in 2 in.	Forms Available†	Welding Qualities‡‡			No.
								Arc	Gas	Resistance	
66	Carbon Moly. (under ¾ gauge)	U.S. Steel Corp., Pittsburgh, Pa.	S. .040 max.; P. .040 max.; C. .18 max.; Mn. .80-1.10; Si. .15-.25; Mo. .40-.60.	43.5	72	x	P.	B[1]	D	D	66
67	Carbon Moly. (over ¾ gauge)	U.S. Steel Corp., Pittsburgh, Pa.	S. .040 max.; P. .040 max.; C. .20 max.; Mn. .80-1.10; Si. .15-.25; Mo. .40-.60	40	70	x	P.	B[1]	D	D	67
68	Carbon Moly. High Manganese	U.S. Steel Corp., Pittsburgh, Pa.	S. 040 max.; P. .035 max.; C. .25 max.; Mn. 1.15-1.50; Si. .25 max.; Mo. .40-.60	65	80-105	y	P.	B[1]	D	D	68
69	Carbon Nickel	Lukens Steel Co., Coatesville, Pa.	S. .018; P. .014; C. .24; Mn. .62; Si. .22; Ni. 3.52	54	94	22	P.	B[10]	B[10]	B[10]	69
70	Carbon-Silicon A-201-A	Lukens Steel Co.,‡ Coatesvile, Pa.	S. .03; P. .02; C. .18; Mn. .60; Si. .20	38	62	35	S, P.	A	A	A	70
71	Carbon-Silicon A-201-B	Lukens Steel Co., Coatesville, Pa.	S. .035; P. .017; C. .22, Mn. .65; Si. .18	40	67	33	P.	A	A	A	71
72	Carbon-Silicon A-212-A	Lukens Steel Co.,‡ Coatesville, Pa.	S. .032; P. .018; C. .25; Mn. .70; Si. .21	42	72	31	S, P.	A	A	A	72
73	Carbon-Silicon A-212-B	Lukens Steel Co.,‡ Coatesville, Pa.	S. .031; P. .020; C. .28; Mn. .77; Si. .20	44.5	77	29	S, P.	A[11]	A[11]	A[11]	73
74	Chromium Copper Nickel	Lukens Steel Co., Coatesville, Pa.	S. .029; P. .020; C. .14; Mn. .45; Si. .15; Ni. .50; Cr. .70; Cu. .62	43	73	30	P.	A	A	A	74
75	Chromium Manganese	Alan Wood Steel Co., Conshohoken, Pa.	S. .027 max.; P. .023 max.; C. .30; Mn. .98; Si. .21; Cr. .48	t	t	t	S, P.	B[8]	B[8]	B[8]	75
76	Chromium Manganese	Lukens Steel Co., Coatesville, Pa.	S. .027; P. .023; C. .40; Mn. .98; Si. .21; Cr. .48	70	110	18	P.	C	C	C	76
77	Cor-Ten	U. S. Steel Corp., Pittsburgh, Pa.	S. .03 max.; P. .07-.20; C. .12 max.; Mn. 1.10-1.60; Si. .25-1.00; Cu. 30-50 Ni. .55 max; Cr. .50-1.50	50	70	22	S, P, CR, HR, B, W.	A	A	A	77
78	Cr-Mn-Si (CMS) A-202-A	Lukens Steel Co., Coatesville, Pa.	S. .030; P. .016; C. .16; Mn. 1.30; Si. .75; Cr. .50	54	85	24	P.	B[10]	B[10]	B[10]	78
79	Cr-Mn-Si A-202-B	Lukens Steel Co., Coatesville, Pa.	S. .032; P. .019; C. .22; Mn. 1.27; Si. .80; Cr. .53	60	95	22	P.	B[10]	B[10]	B[10]	79

*Yield strength is that load which will produce an elongation of .002″ in 1″. The value is obtained from stress-strain curves, and is based on a 29,000,000 psi Modulus of Elasticity for steel, 6,500,000 psi for magnesium alloys, 10,300,000 psi for aluminum, 15,000,000 psi for brasses, 20,000,000 psi for 70/30 cupro-nickel

**Single figure (50) indicates minimum value. Double figures (28-50) indicate range, which varies because of production processes or other causes; e.g., heat treatment, annealing, cold rolling, drawing, etc.

†Available forms: P = plates, S = sheets, CR = cold rolled, HR = hot rolled, B = bars, W = wire, T = tubing, R = rods.

‡‡Welding Qualities: A = Readily weldable. B = Weldable under favorable conditions (see footnotes). C = Not ordinarily weldable. D = No welding data available. X = This method of gas welding may be applied successfully to the chromium nickel and straight chromium alloys under certain conditions, but it is not as well adapted for general work with these alloys as is the metallic arc method. It is frequently employed on 20 gauge and lighter material.

‡Also available from Alan Wood Steel Co., Conshohocken, Pa.

t. Used as furnished. x. 1,500,000/T. S. y. 2,000,000/T. S. z. As rolled.

1. The necessity for stress relief annealing usually depends on the character of part and service. Adequate preheat can confer practically the same metallurgical advantages as post heating. 2. Can be flash welded. 3. Preheat during welding is required; the temperature during welding should be suitable for the composition and thickness of the material. Special welding technique required also. 4. Annealing suggested to remove brittleness and to improve ductility. 5. Thin sections. 6. Post heat. 7. Unable to make ductile. 8. Preheat—cool slowly. 9. Low preheat 100-300 F is desired or recommended during welding. 10. Preheat during welding is required; the temperature during welding should be suitable for the composition and thickness of the material. 11. Low preheat 100-300 F is desired or recommended during welding in heavy sections.

WELDABLE ALLOY MATERIALS—FERROUS

No.	Material	Manufacturer	Nominal Chemical Composition (Percent)	Yield Stgth.* 1,000 psi	Tensile Stgth. ** 1,000 psi	Elongation % in 2 in.	Forms Available†	Welding Qualities‡‡			No.
								Arc	Gas	Resistance	
80	Cumoloy	Republic Steel Corp., Massillon, Ohio.	S. .04 max.; P. .04 max.; C. .25 max.; Mn. .70-1.25; Si. .20 max; Cu. .65-.85; Mo. .20-.30	50	70	25	S, P, CR, B	A	D	A	80
81	Disston 843	Henry Disston & Sons, Tacony, Phila., Pa.	S. .025; P. .025; C. .40-.50; Mn. .70-.90; Si. .40-.60; Cr. .70-.90	145.	168.1	10	S, P, CR, HR, B	B[8]	B[8]	D	81
82	Disston 844	Henry Disston & Sons, Tacony, Phila., Pa.	S. .025; P. .025; C. .95-1.05; Mn. .25-.35; Si. .20-.30; Cr. 1.00-1.25	123.5	165.4	12	S, P, CR, HR, B	B[8]	B[8]	D	82
83	Disston 845c	Henry Disston & Sons, Tacony, Phila., Pa.	S. .025; P. .025; C. .72; Mn. .67; Si. .29; Cr. 1.21; V. .24; Mo. .71	175	186	16	S, P, CR, HR, B	B[8]	B[8]	D	83
84	Disston 847	Henry Disston & Sons, Tacony, Phila., Pa.	S. .025; P. .025; C. .50-.60; Mn. .69-.89; Si. 1.24-1.49; Cr. .39-.59; V. .03-.15	131.2	173.1	10.5	S, P, B	B[8]	B[8]	D	84
85	Disston 857	Henry Disston & Sons, Tacony, Phila., Pa.	S. .025; P. .025; C. .44; Mn. .26; Si. .96; Cr. 8.77; Mo. 1.84; Cu. 1.83	168	227	11.3	S, P, CR	C	B[8]	D	85
86	Disston 858	Henry Disston & Sons, Tacony, Phila., Pa.	S. .025; P. .025; C. .70; Mn. .34; Si. .22; Ni. 2.08; V. .10; Mo. .10	160	175	19	S, P, CR	B[8]	B[8]	B[8]	86
87	Disston 859	Henry Disston & Sons, Tacony, Phila., Pa.	S. .025; P. .025; C. .86; Mn. .39; Si. .30; Ni. 2.11; V. .13	153.2	183.4	9.4	S, P, CR	B[8]	B[8]	B[8]	87
88	Disston Stainless A.	Henry Disston & Sons, Tacony, Phila., Pa.	S. .025; P. .025; C. .25; Ni. .13; Cr. 13.75.	148.5	174.2	4	S, P, CR, HR, B	B[8]	B[8]	D	88
89	Disston Stainless Iron.	Henry Disston & Sons, Tacony, Phila., Pa.	S. .025; P. .025; C. .10; Mn. .43; Si. .41; Ni. .41; Cr. 15.18.	103.1	121.	21	S, P, HR, B.	B[8]	B[8]	B[8]	89
90	Elkro	Henry Disston & Sons, Tacony, Phila., Pa.	S. .025; P. .025; C. .45-.55; Mn. .50-.80; Si. .20-.30; Cr. .80-1.10; V. .15-.25	138.4	159.2	10.5	S, P, CR, HR, B	B[8]	B[8]	D	90
91	Enduro	Henry Disston & Sons, Tacony, Phila., Pa.	S. .025; P. .025; C. .90-1.00; Mn. .15-.30; Si. .10-.20; V. .20-.30	183.8	203.6	6.5	S, P, CR, HR, B	A	A	B[8]	91
92	Enduro S-1	Republic Steel Corp., Massillon, Ohio.	S. .030 max.; P. .030 max.; C. .15 max.; Mn. .60 max.; Si. .50 max.; Cr. 10.0-14.0	35-45	65-85	25-35	S, P, CR, B, W	B	B	B	92
93	Enduro AA	Republic Steel Corp., Massillon, Ohio.	S. .030 max.; P. .030 max.; C. .12 max.; Mn. .60 max.; Si. .50 max.; Cr. 14.0-18.0	45-55	75-90	20-30	S, P, CR, B, W	B	B	B	93
94	Enduro HC	Republic Steel Corp., Massillon, Ohio.	S. .030 max.; P. .030 max.; C. .35 max.; Mn. .60 max.; Si. .50 max.; Cr. 23.0-30.0	45-60	75-95	20-30	S, P, CR, B, W	B	B	B	94
95	Enduro 18-8	Republic Steel Corp., Massillon, Ohio.	S. .030 max.; P. .030 max.; C. .20 max.; Mn. 2.00 max.; Si. .75 max.; Ni. 8.0-10.0; Cr. 17.5-20.0	35-45	80-90	55-60	S, P, CR, B, W	A	A	A	95
96	Enduro 18-8S	Republic Steel Corp., Massillon, Ohio.	S. .030 max.; P. .030 max.; C. .08 max.; Mn. 2.00; Ni. 8.0-10.0; Cr. 18.0-20.0; Si..75	35-45	80-90	55-60	S, P, CR, B, W	A	A	A	96
97	Enduro 18-8S Ti	Republic Steel Corp., Massillon, Ohio.	S. .030 max.; P. .030 max.; C. .08 max.; Mn. 2.00 max.; Si. .75 max.; Ni. 8.0-10.0; Cr. 17.0-19.0	35-45	80-90	55-60	S, P, CR, B, W	A	A	A	97
98	Enduro 18-8 SCb	Republic Steel Corp., Massillon, Ohio.	S. .030 max.; P. .030 max.; C. .08 max.; Mn. 2.00; Si. .75; Ni. 8.0-12.0; Cr. 17.0-19.0	35-45	80-90	55-60	S, P, CR, B, W	A	A	A	98

No.	Material	Manufacturer	Nominal Chemical Composition (Percent)	Yield Stgth. * 1,000 psi	Tensile Stgth. ** 1,000 psi	Elongation % in 2 in.	Forms Available†	Welding Qualities‡‡			No.
								Arc	Gas	Resistance	
98		Massillon, Ohio.	Mn. 2.00; Si. .75; Ni. 8.0-12.0; Cr. 17.0-19.0	35-45	80-90	55-60	S, P, CR, B, W	A	A	A	98
99	Enduro 18-8 S Mo	Republic Steel Corp., Massillon, Ohio.	S. .030 max.; P. .030 max.; C. .08 max.; Mn. 2.00; Si. .75 max.; Ni. 9.0-14.0; Cr. 16.0-18.0; Mo. 2.0-3.0	35-45	80-90	55-60	S, P, CR, B, W	A	A	A	99
100	Enduro H C N	Republic Steel Corp., Massillon, Ohio.	S. .030 max.; P. .030 max.; C. .20 max.; Mn. 2.00 max.; Ni. 11.0-14.0; Cr. 22.0 -26.0; Si. .75	40-60	90-110	50-65	S, P, CR, B, W	A	A	A	100
101	Enduro N C 3	Republic Steel Corp., Massillon, Ohio.	S. .030 max.; P. .030 max.; C. .25 max.; Mn. 2.00 max.; Si. .75; Ni. 19.0-21.0; Cr. 23.0-26.0	40-60	90-110	45-55	S, P, CR, B, W	A	A	A	101
102	Granite City Hi-Yield	Granite City Steel Co., Granite City, Ill.	S. .035; P. .080 max.; C. .18; Mn. 1.05; Si. .25; Cr. .10; Cu. .30	50	70	28	S, P, CR	A	A	B[12]	102
103	"Hack Saw"	Henry Disston & Sons, Tacony, Phila., Pa.	S. .025; P. .025; C. 1.15-1.25; Mn. .25-.35; Si. .15-.25; Cr. .10-.20; W. .90-1.10	153.3	184	5.5	S	C	C	D	103
104	IngAclad Stainless Clad Steel Type 302	Ingersoll Steel & Disc, Chicago	S. .030; P. .030; C. .08-.20; Mn. 1.25; Si. .50; Ni. 8-10; Cr. 17.5-20	40-50	60-70	50-40	S, P	A	C	B[5]	104
105	IngAclad Stainless Clad Steel Type 304	Ingersoll Steel & Disc, Chicago	S. .030; P. .030; C. .08 max.; Mn. .60; Si. .50; Ni. 8-10; Cr. 18-20	40-50	60-70	50-40	S, P	A	C	B[5]	105
106	IngAclad Stainless Clad Steel Type 316	Ingersoll Steel & Disc, Chicago	S. .030; P. .030; C. .10 max.; Mn. .60; Si. .50, Ni. 10-14; Cr. 16-18; Mo. 2-3	40-50	60-70	50-40	S, P	A	C	B[5]	106
107	IngAclad Stainless Clad Steel Type 317	Ingersoll Steel & Disc, Chicago	S. .030; P. .030; C. .10 max., Mn. .60 Si. .50; Ni. 10-14; Cr. 18-20; Mo. 3-4	40-50	60-70	50-40	S, P	A	C	B[5]	107
108	IngAclad Stainless Clad Steel Type 347	Ingersoll Steel & Disc, Chicago	S. .030; P. .030; C. .10 max.; Mn. .60; Si. .50; Ni. 8-12; Cr. 17-20; Cb. 10xC	40-50	60-70	50-40	S, P	A	C	B[5]	108
109	Ingersoll Stainless Steel Type 302	Ingersoll Steel & Disc, Chicago	S. .030; P. .030; C. .08-.20; Mn. .60; Si. .50; Ni. 8-10; Cr. 17.5-20.	35-45	80-90	65-55	S	A	C	B[5]	109
110	Ingersoll Stainless Steel Type 304	Ingersoll Steel & Disc, Chicago	S. .030; P. .030; C. .08 max.; Mn. .60; Si. .50; Ni. 8-10; Cr. 18-20	35-45	80-90	65-55	S	A	C	B[5]	110

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**Single figure (50) indicates minimum value. Double figures (28-50) indicate range, which varies because of production processes or other causes; e.g., heat treatment, annealing, cold rolling, drawing, etc.

†Available forms: P = plates, S = sheets, CR = cold rolled, HR = hot rolled, B = bars, W = wire, T = tubing, R = rods.

‡‡Welding Qualities: A = Readily weldable. B = Weldable under favorable conditions (see footnotes). C = Not ordinarily weldable. D = No welding data available. X = This method of gas welding may be applied successfully to the chromium nickel and straight chromium alloys under certain conditions, but it is not as well adapted for general work with these alloys as is the metallic arc method. It is frequently employed on 20 gauge and lighter material.

1. The necessity for stress relief annealing usually depends on the character of part and service. Adequate preheat can confer practically the same metallurgical advantages as post heating. 2. Can be flash welded. 3. Preheat during welding is required, the temperature during welding should be suitable for the composition and thickness of the material. Special welding technique required also. 4. Annealing suggested to remove brittleness and to improve ductility. 5. Thin sections. 6. Post heat. 7. Unable to make ductile. 8. Preheat—cool slowly. 9. Low preheat 100-300 F is desired or recommended during welding. 10. Preheat during welding is required; the temperature during welding should be suitable for the composition and thickness of the material. 11. Low preheat 100-300 F is desired or recommended during welding in heavy sections. 12. Pickled surface required.

No.	Material	Manufacturer	Nominal Chemical Composition (Percent)	Yield Stgth.* 1,000 psi	Tensile Stgth. ** 1,000 psi	Elongation % in 2 in.	Forms Available†	Welding Qualities‡‡			No.
								Arc	Gas	Resistance	
111	Ingersoll Stainless Steel Type 316	Ingersoll Steel & Disc, Chicago	S. .030; P. .030; C. .10 max.; Mn. .60; Si. .50; Ni. 10-14; Cr. 16-18; Mo. 2-3	35-50	80-90	65-55	S	A	C	B[5]	111
112	Ingersoll Stainless Steel Type 317	Ingersoll Steel & Disc, Chicago	S. .030; P. .030; C. .10 max.; Mn. .60; Si. .50; Ni. 10-14; Cr. 18-20; Mo. 3-4	35-55	80-90	65-55	S	A	C	B[5]	112
113	Ingersoll Stainless Steel Type 347	Ingersoll Steel & Disc, Chicago	S. .030; P. .030; C. .10 max.; Mn. .60; Si. .50; Ni. 8-12; Cr 17-20; Cb. IOxC	35-45	80-90	60-55	S	A	C	B[5]	113
114	Ingersoll Stainless Steel Type 309	Ingersoll Steel & Disc, Chicago	S. .030; P. .030; C. .20 max.; Mn. .60; Si. .50; Ni. 12-14; Cr. 22-26	40-60	90-110	65-50	S	A	C	D	114
115	Inland Hi-Steel	Inland Steel Co., Chicago	S. .05 max.; P. .10-.15; C. .12 max.; Mn. .50-.70; Si. .10 max.; Ni. .45-.65; Co. .90-1.25	55-70	70-85	20-30	S, P, CR, HR, B	A	A	A	115
116	Jessop Silver-ply	Jessop Steel Co., Washington, Pa.	Carbon steel bonded integrally on one or both sides with various types of stainless steels.				S, P	A	C	B[5]	116
117	Keystone Chisel	Henry Disston & Sons, Phila., Pa.	S. .025; P. .025; C. .45-.55; Mn. .20-.35; Si. .15-.25; Cr. 1.00-1.20; W. 1.80-2.10; V. .10-.25	158	168.3	13	S, P, HR, B	B[8]	B[8]	D	117
118	Kut-Kwick	Henry Disston & Sons, Phila., Pa.	S. .025; P. .025; C. .76-.80; Mn. .20-.30; Si. .20-.30; Cr. 3.50-4.00; W. 17.5-19.0; V. .75-1.20	228.7	252.4	3.65	S, P, B	C	C	C	118
119	Lo Cro 46 Mo Type 501	Crucible Steel Co., of America, N. Y.	C. over 0.10; Cr. 4-6; Mo. 0.40-0.60	25-35	60-145	40-30	S, P	A	X	B[13]	119
120	Lo Cro 46 Mo Type 502	Crucible Steel Co., of America, N. Y.	C. 0.10 max.; Cr. 4-6; Mo. 0.40-0.60	25-35	60-80	40-30	S, P	A	X	B[13]	120
121	Low Carbon Nickel A-203-A	Lukens Steel Co., Coatesville, Pa.	S. .027; P. .016; C. .16; Mn. .65; Si. .19; Ni. 2.40	41	72.5	35	P	A	A	A	121
122	Low Carbon Nickel A-203-B	Lukens Steel Co., Coatesville, Pa.	S. .030; P. .015; C. .19; Mn. .70; Si. .22; Ni. 2.61	43	77	32	P	B[9]	B[9]	B[9]	122
123	Low Carbon Nickel A-203-C	Lukens Steel Co., Coatesville, Pa.	S. .028; P. .016; C. .23; Mn. .73; Si. .20; Ni. 2.51	49	85	29	P	B[10]	B[10]	B[10]	123
124	Low Chromium Molybdenum	Lukens Steel Co., Coatesville, Pa.	S. .027; P. .021; C. 15; Mn. .81; Si. .20; Cr. .42; Mo. .23	43.5	73	31	P	A	A	A	124
125	Manganese Molybdenum A	Lukens Steel Co., Coatesville, Pa.	S. .030; P. .015; C. .15; Mn. 1.10; Si. .17; Mo. .42	55	80	34	P	A[11]	A[11]	A[11]	125
126	Manganese Molybdenum B	Lukens Steel Co., Coatesville, Pa.	S. .032; P. .018; C. .19; Mn. 1.30; Si. .20 Mo. .47	60	88	30	P	B[11]	B[11]	B[11]	126
127	Manganese Molybdenum C	Lukens Steel Co., Coatesville, Pa.	S. .030; P. .020; C. .22; Mn. 1.50; Si. .21; Mo. .52	70	100	25	P	B[10]	B[10]	B[10]	127

No.	Material	Manufacturer	Nominal Chemical Composition (Percent)	Yield Stgth. * 1,000 psi	Tensile Stgth. ** 1,000 psi	Elongation % in 2 in.	Forms Available†	Welding Qualities‡‡			No.
								Arc	Gas	Resistance	
128	Manganese-Vanadium.	Lukens Steel Co., Coatesville, Pa.	S. .026; P. .018; C. .17; Mn. 1.30; Si. .22; V. .10.	55	84	28	P	A[11]	A[11]	A[11]	128
129	Mansil	Henry Disston & Sons, Phila., Pa.	S. .025; P. .025; C. .85-.95; Mn.1.00-1.25; Si. .25-.45; Cr. .40-.60; W. .40-.60	157.5	185.1	5.5	S, P, HR, B	C	B[8]	D	129
130	Man-Ten	U. S. Steel Corp., Pittsburgh, Pa.	S. .05 max.; C. .25 max.; Mn. 1.10-1.60; Si. .30 max.; Cu. .20 min.; P. .04 max.	50	75	20	S, P, HR, B	A	A	A	130
131	Mayari R	Bethlehem Steel Co., Bethlehem, Pa.	C. 0.12 max.; Mn. 0.50-1.00; Si. 0.05-0.50; Cu. 0.50-0.70; Ni. 0.25-0.75; P.0.08-0.12; Cr. 0.20-1.00	50	70	22	S, P, CR, HR	A	A	A	131
132	N-A-X High Tensile	Great Lakes Steel Corp. Ecorse, Detroit, Mich.	S. .04 max.; P. .04 max.; C. .10-.18; Mn. .50-.75; Si. .70-.90; Cr. .50-.65; Zr. .10-.20; Mo. .10-.20	50	70	30	S, P, CR, HR, B, W, T	A	A	A	132
133	3-½% Nickel (SAE 2315)	Lukens Steel Co. Coatesville, Pa.	S. 031; P. .015; C. .14; Mn. .42; Si. .18; Ni. 3.41	50	80	25	P	B[10]	B[10]	B[10]	133
134	3½% Nickel	Alan Wood Steel Co., Conshohocken, Pa.	S. .04 max.; P. .04 max.; C. .28-.33; Mn. .60-.80; Si. .15-.30; Ni. 3.25-3.75	a	a	a	S, P	B[1]	D	D	134
135	Nichroman	Henry Disston & Sons, Tacony, Phila., Pa.	S. .025; P. .025; C. .65-.75; Mn. .35-.40; Si. .10-.25; Ni. 1.55-1.75; Cr. .90-1.10; Cu. .25-.45	186	206.9	6	S, P, CR, HR, B	B[8]	B[8]	D	135
136	Nivan	Henry Disston & Sons, Tacony, Phila., Pa.	S. .025; P. .025; C. .85-.95; Mn. .25-.35; Si. .20-.30, Ni. 1.25-1.50; Cr. .30-.45	138	182.1	8	S, P, CR, B	B[8]	B[8]	D	136
137	Otiscoloy	Jones & Laughlin Steel Corp., Pittsburgh, Pa.	S. .050 max.; C. .10; Mn. 1.15; Si. .05; Ni. .10; Cr. .05; Cu. .30; P. .12	40-50	63-70	26-24	S, P, CR	A	A	A	137
138	Polaris	Henry Disston & Sons Tacony, Phila., Pa.	S. .025; P. .025; C. .88; Mn. .33; Si. .34; Ni. .75; Cr. .26; V. .07; Mo. .16	140.8	179.5	10	S, P, CR, HR, B	B[8]	B[8]	B[8]	138
139	Republic Double Strength #1	Republic Steel Corp., Massillon, Ohio.	S. .04 max.; P. .04 max.; C. .12 max.; Mn. .50-1.0; Si. .04 max.; Ni. .50-1.5; Cu. .50-1.5; Mo. .10 min.	50	70	25	S, P, CR, B	A	A	A	139

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**Single figure (50) indicates minimum value. Double figures (28-50) indicate range, which varies because of production processes or other causes; e.g., heat treatment, annealing cold rolling, drawing, etc.

†Available forms: P=plates, S=sheets, CR=cold rolled, HR=hot rolled, B=bars, W=wire, T=tubing, R=rods.

‡‡Welding Qualities: A=Readily weldable. B=Weldable under favorable conditions (see footnotes). C=Not ordinarily weldable. D=No welding data available. X=This method of gas welding may be applied successfully to the chromium nickel and straight chromium alloys under certain conditions, but it is not as well adapted for general work with these alloys as is the metallic arc method. It is frequently employed on 20 gauge and lighter material.

a. Nickel Steel to A.S.T.M. Specs., b. Carbon Moly to A.S.T.M. Specs., c. Manganese Vanadium to A.S.T.M. Specs., d. Chrome Moly to U.S. Army or Navy Specs., e. Manganese Vanadium to U.S. Navy Specs.

1. The necessity for stress relief annealing usually depends on the character of part and service. Adequate preheat can confer practically the same metallurgical advantages as post heating. 2. Can be flash welded. 3. Preheat during welding is required; the temperature during welding should be suitable for the composition and thickness of the material. Special welding technique required also. 4. Annealing suggested to remove brittleness and to improve ductility. 5. Thin sections. 6. Post heat. 7. Unable to make ductile. 8. Preheat—cool slowly. 9. Low preheat 100-300 F is desired or recommended during welding. 10. Preheat during welding is required; the temperature during welding should be suitable for the composition and thickness of the material. 11. Low preheat 100-300 F is desired or recommended during welding in heavy sections. 12. Pickled surface required. 13. Heat treatment required. 14. Stress relieve after welding.

No.	Material	Manufacturer	Nominal Chemical Composition (Percent)	Yield Stgth. * 1,000 psi	Tensile Stgth. ** 1,000 psi	Elongation % in 2 in.	Forms Available†	Welding Qualities‡‡			No.
								Arc	Gas	Resistance	
140	Republic Double Strength #1 A	Republic Steel Corp., Massillon, Ohio	S. .04 max.; P. .04 max.; C. .30 max.; Mn. .50-1.0; Si. .04 max.; Ni. .50-1.5; Cu. .50-1.5; Mo. .10 min.	70	90	15	S, P, CR, B	A[14]	D	B[14]	140
141	Rezistal Grade "A"	Crucible Steel Co. of America, New York	C. 30-40; Cr. 12-14	60-200	95-300	30-2	S, P	B	X	B[13]	141
142	Rezistal Grade "B"	Crucible Steel Co. of America, New York	C. 50-70; Cr. 14-18	50-250	90-300	1-35	S, P	B	X	B[13]	142
143	Rezistal FM 188	Crucible Steel Co. of America, New York	C. 0.20 max.; Ni. 8-10; Cr. 17.5-20; Mo. 0.60 max.; S. 0.07 min.	30-40	75-90	60-55	S, P	A	X	B[13]	143
144	Rezistal KA2	Crucible Steel Co. of America, New York	C. 0.20; Mn. 1.25 max.; Ni. 8-10; Cr. 17-20	30-150	75-180	60-10	S, P	A	X	B[13]	144
145	Rezistal KA2S	Crucible Steel Co. of America, New York	C. 0.08 max.; Mn. 2.0 max.; Cr. 18-20				S, P	A	X	A	145
146	Rezistal KA2SMo	Crucible Steel Co. of America, New York	C. 0.10 max.; Ni. 10-14; Cr. 16-20; Mo. 2-4	40-50	90-100	60-50	S, P	A	X	A	146
147	Rezistal KA2SCb	Crucible Steel Co. of America, New York	C. 0.10 max.; Ni. 8-12; Cr. 17-20; Cb. 10; C min	30-40	75-95	60-55	S, P	A	X	A	147
148	Rezistal KA2ST	Crucible Steel Co. of America, New York	C. 0.10 max.; Ni. 7-10; Cr. 17-20; T. 4C min.	30-40	75-95	60-55	S, P	A	X	A	148
149	Rezistal 2 C	Crucible Steel Co. of America, New York	C. over 0.08; Mn. 1.25 max.; Si. 2-3; Ni. 8-10; Cr. 18-20	40-50	90-100	60-50	S, P	A	X	A	149
150	Rezistal 3	Crucible Steel Co. of America, New York	C. 0.20 max.; Ni. 12-14; Cr. 22-26	40-50	95-105	40	S, P	A	X	A	150
151	Rezistal 4	Crucible Steel Co. of America, New York	C. 0.25 max.; Ni. 24-26; Cr. 19-21	45-50	90-110	40-30	S, P	A	X	A	151
152	Rezistal 7	Crucible Steel Co. of America, New York	C. 0.25 max.; Ni. 19-21; Cr. 24-26	45-55	100-110	55-45	S, P	A	X	A	152
153	Rezistal 12	Crucible Steel Co. of America, New York	C. 0.15 max.; Cr. 10-14	40-170	70-185	35-10	S, P	A	X	B[13]	153
154	Rezistal 17	Crucible Steel Co. of America, New York	C. 0.12 max.; Cr. 14-18	45-55	75-85	40-30	S, P	A	X	B[15]	154
155	Rezistal 20	Crucible Steel Co. of America, New York	C. 0.35 max.; Cr. 18-23	45-55	75-85	40-30	S, P	A	X	B[13]	155
156	Rezistal 27	Crucible Steel Co. of America, New York	C. 0.35 max.; Cr. 23-30	55-65	80-90	30-20	S. P	A	X	B[13]	156
157	Rezistal 162	Crucible Steel Co. of America, New York	C. 0.15 max.; Ni. 2.00 max.; Cr. 14-18	85-170	105-200	15-30	S, P	A	X	B[15]	157
158	Rezistal 329	Crucible Steel Co. of America, New York	Ni. 3-5; Cr. 25-30; Mo. 1.-1.5	85-95	105-125	30-20	S, P	A	X	A	158
159	Rezistal 2600	Crucible Steel Co. of America, New York	C. 0.30-0.50; Ni. 19-23; Cr. 7-10; Cu. 1.-1.5	45-55	85-95	40-30	S, P	A	X	A	159
160	Stainless Steel 301	The stainless steels are grouped here in accordance to type numbers assigned by the American Iron and Steel Institute. According to reports of this survey these stainless steels are generally available from the following producers: Allegheny-Ludlum Steel Corp., Pittsburgh, Pa. American Rolling Mill Co., Middletown, Ohio. Henry Disston & Sons, Philadelphia, Pa. Ingersoll Steel & Disc Div., Borg-Warner Corp., New Castle, Ind. Republic Steel Corp., Massillon, Ohio. United States Steel Corp., Pittsburgh, Pa.	Fe; Cr. 16-18; Ni. 6-8; C. 0.09-0.20; Mn. 2.00 max.	35-45	90-110	55-45	S, P, CR, HR, B, W	B[16]	X	A	160
161	Stainless Steel 302		Fe; Cr. 17-19; Ni. 8-10; C. 0.09-0.20; Mn. 2.00 max.	35-45	80-110	65-55	S, P, CR, HR, B, W, T	A	X	A	161
162	Stainless Steel 302B		Fe; Cr. 17-19; Ni. 8-10; C. .09-.20; Si. 2-3; Mn. 2.00 max.	40-50	80-100	60-50	S, P, CR, HR, B, W	D	X	B[1]	162
163	Stainless Steel 303		Cr. 17-19; Ni. 8-10; C. 0.2 max; S or Se. .07 min.; Mo. .60 max.; Mn. 2 max.	35-45	80-90	60-50	S, P, CR, HR, B, W	D	X	B[1]	163
164	Stainless Steel 304		Fe.; Cr. 18-20; Ni. 8-10; C. 0.08 max.; Mn. 2.0 max.	30-40	75-85	65-55	S, P, CR, HR, B, W, T	A	X	A	164
165	Stainless Steel 308		Fe; Cr. 19-22; Ni. 10-12; C. 0.08 max; Mn. 2 max.	30-40	80-100	60-50	S, P, CR, HR, B, W, T	A	X	A	165
166	Stainless Steel 309		Cr. 22-26; Ni. 12-13; C. .20 max.; Mn. 2 max.	40-50	90-100	50-40	S, P, CR, HR, B, W	B[16]	X	A	166
167	Stainless Steel 310		Cr. 24-26; Ni. 19-21; C. .25 max.; Mn. 2 max.	40-55	90-110	50-40	S, P, CR, HR, B, W, T	A	X	A	167

No.	Material	Manufacturer	Nominal Chemical Composition (Percent)	Yield Stgth. * 1,000 psi	Tensile Stgth. ** 1,000 psi	Elongation % in 2 in.	Forms Available†	Welding Qualities‡‡			No.
								Arc	Gas	Resistance	
168	Stainless Steel 311		Cr. 18-20; Ni. 24-26; C. .25 max.; Mn. 2 max.	45-50	90-110	40-30	S, P, CR, HR, B, W	A	X	A	168
169	Stainless Steel 316		Cr.16-18; Ni. 10-14; C. .10 max.; Mn. 2. max.; Mo. 2-3	35-45	80-100	60-50	S, P, CR, HR, B, W, T	A	X	A	169
170	Stainless Steel 317		Cr. 17.5-20; Ni. 10-14; C. .10 max.; Mo. 3-4; Mn. 2. max.	40-50	90-100	50-40	S, P, CR, HR, B, W, T	A	X	A	170
171	Stainless Steel 321		Cr. 17-19; Ni. 8-12; C. .10 max.; Ti. min. 4 x C; Mn. 2. max.	30-40	80-90	60-50	S, P, CR, HR, B, W, T	A	B[16]	A	171
172	Stainless Steel 325		Cr. 7-10; Ni. 19.3-23.5; C. .50 max.; Cu. 1-1.5	45-55	85-95	40-30	S, P, CR, HR, B, W	A	X	A	172
173	Stainless Steel 329	The stainless steels are grouped here in accordance to type numbers assigned by the American Iron and Steel Institute. According to reports of this survey these stainless steels are generally available from the following producers:	Cr. 23-28; Ni. 2.5-5; C. .20 max.; Mo. 1-1.5	75	100	20	S, P, CR, HR, B, W	A	X	A	173
174	Stainless Steel 347		Cr. 17-19; Ni. 8-12; C. .10 max.; Cb 10 x C min.; Mn. 2. max.	35-45	85-95	55-45	S, P, CR, HR, B, W, T	A	B[16]	A	174
175	Stainless Steel 403	Allegheny-Ludlum Steel Corp., Pittsburgh, Pa.	Cr. 11.5-13; C. 0.15 max.	30-40	60-85	35-25	S, P, CR, HR, B, W, T				175
176	Stainless Steel 410		Cr. 10-14; C. 0.15 max.	30-40	60-75	35-25	S, P, CR, HR, B, W, T	B[16]	X	B[4]	176
177	Stainless Steel 414	American Rolling Mill Co., Middletown, Ohio.	Cr. 10-14; Ni. 2.5 max.; C. .15 max.	113	128	20	S, P, HR, B, W.	B[16]	X	B[4]	177
178	Stainless Steel 416	Henry Disston & Sons, Philadelphia, Pa.	Cr. 12-14; C. 0.15 max.; S. or Se. 0.07 min.; Mo. 0.60 max.	40-60	70-85	35-25	S, P, CR, HR, B, W, T	D	X	D	178
179	Stainless Steel 420	Ingersoll Steel & Disc Div., Borg-Warner Corp., New Castle, Ind.	Cr. 12-14; C. over .15	55-185	105-225	23-8	S, P, CR, HR, B, W	B[16]	X	B[7]	179
180	Stainless Steel 420F	Republic Steel Corp., Massillon, Ohio.	Cr. 12-14; C. over .15; S. or Se. 0.07 min. Mo. 0.60 max.	76	134	6-7		B[16]	X	B[4]	180
181	Stainless Steel 430	United States Steel Corp., Pittsburgh, Pa.	Cr. 14-18; C. 0.12 max.	40-50	70-80	30-20	S, P, CR, HR, B, W, T	B[16]	X	B[4]	181
182	Stainless Steel 430F		Cr. 14-18; C. 0.12 max.; S. or Se. 0.07 min.; Mo. 0.60 max.	40-55	70-85	30-20	CR, HR, B, W	D	X	D	182
183	Stainless Steel 440		Cr. 14-18; C. over .12	60-190	100-250	23-3	S, CR, HR, B, W	D	X	D	183
184	Stainless Steel 441		Cr. 14-18; Ni. 2.5 max.; C. over .20	186	235	6	S, P, CR, HR, B, W	D	X	B[4]	184
185	Stainless Steel 442		Cr. 18-23; C. 0.35 max.	45-55	75-85	30-20	S, P, CR, HR, B	B[16]	X	B[4]	185
186	Stainless Steel 446		Cr. 23-30; C. 0.35 max.	50-60	80-90	30-20	S, P, CR, HR, B, W, T	B[16]	X	B[4]	186

*Yield strength is that load which will produce an elongation of .002″ in 1″. The value is obtained from stress-strain curves, and is based on a 29,000,000 psi Modulus of Elasticity for steel, 6,500,000 psi for magnesium alloys, 10,300,000 psi for aluminum, 15,000,000 psi for brasses, 20,000,000 psi for 70/30 cupro-nickel.

**Single figure (50) indicates minimum value. Double figures (28-50) indicate range, which varies because of production processes or other causes; e.g., heat treatment, annealing, cold rolling, drawing, etc.

†Available forms: P=plates, S=sheets, CR=cold rolled, HR=hot rolled, B=bars, W=wire, T=tubing, R=rods.

‡‡Welding Qualities: A=Readily weldable. B=Weldable under favorable conditions (see footnotes). C=Not ordinarily weldable. D=No welding data available. X=This method of gas welding may be applied successfully to the chromium nickel and straight chromium alloys under certain conditions, but it is not as well adapted for general work with these alloys as is the metallic arc method. It is frequently employed on 20 gauge and lighter material.

a. Nickel Steel to A.S.T.M. Specs., b. Carbon Moly to A.S.T.M. Specs., c. Manganese Vanadium to A.S.T.M. Specs., d. Chrome Moly to U.S. Army or Navy Specs., e. Manganese Vanadium to U.S. Navy Specs.

u. 1,650,000/T. S. v. 1,750,000/T. S. w. 1,500,000/T. S. x. 2,000,000/T. S.

1. The necessity for stress relief annealing usually depends on the character of part and service. Adequate preheat can confer practically the same metallurgical advantages as post heating. 2. Can be flash welded. 3. Preheat during welding is required; the temperature during welding should be suitable for the composition and thickness of the material. Special welding technique required also. 4. Annealing suggested to remove brittleness and to improve ductility. 5. Thin sections. 6. Post heat. 7. Unable to make ductile. 8. Preheat—cool slowly. 9. Low preheat 100-300 F is desired or recommended during welding. 10. Preheat during welding is required; the temperature during welding should be suitable for the composition and thickness of the material. 11. Low preheat 100-300 F is desired or recommended during welding in heavy sections. 12. Pickled surface required. 13. Heat treatment required. 14. Stress relieve after welding. 15. Impact strength increased by annealing. 16. Use austenitic rod; e.g., 17 CR rod annealed.

No.	Material	Manufacturer	Nominal Chemical Composition (Percent)	Yield Stgth. * 1,000 psi	Tensile Stgth. ** 1,000 psi	Elongation % in 2 in.	Forms Available†	Welding Qualities‡‡			No.
								Arc	Gas	Resistance	
187	Stainless Steel 501		Cr. 4-6; C. over .10	30-40	65-75	35-25	S, P, CR, HR, B, W, T	B[16]	X	B[4]	187
188	Stainless Steel 502		Cr. 4-6; C. 0.10 max.	30-40	65-75	35-25	S, P, CR, HR, B, W, T	B[16]	X	B[4]	188
189	SAE 2115	Lukens Steel Co., Coatesville, Pa.	S. .033; P. .015; C. .16; Mn. .53; Si. .23; Ni. 1.31	36	67	26	P	A	A	A	189
190	SAE 3135	Alan Wood Steel Co., Conshohocken, Pa.	S. .05 max.; P. .04 max.; C. .35; Mn. .65; Si. .25; Ni. 1.25; Cr. 60.	t	t	t	S, P	B[1]	B[1]	B[1]	190
191	SAE 3140[17]	Lukens Steel Co.,‡ Coatesville, Pa.	S. .022; P. .014; C. .42; Mn. .73; Si. .25; Ni. 1.21; Cr. .73	71	115	22	P	B[3]	B[3]	B[3]	191
192	SAE 3340[17]	Lukens Steel Co., Coatesville, Pa.	S. .022; P. .014; C. .38; Mn. .73; Si. .23; Ni. 3.48; Cr. 1.49	80	143	15	P	C	C	D	192
193	SAE X 4130	Republic Steel Co., Massillon, Ohio‡	S. 0.05 max.; P. 0.04 max.; C. .25-.35; Mn. .40-.60; Cu. .80-1.10; Mo. .15-.25	100	125	18	S, P, B, W.	B[14]	B[14]	D	193
194	SAE 4140	Lukens Steel Co.,‡ Coatesville, Pa.	S. .037; P. .016; C. .39; Mn. .76; Si. .23; Cr. 1.07; Mo. .19	62	115	17	P	B[3]	B[3]	D	194
195	U.S. Army 57-136-8-c(d) U.S. Navy 47-S-14-b	U.S. Steel Corp., Pittsburgh, Pa.	S. .045 max.; P. .040 max.; C. .25-.35; Mn. .40-.60; Si. .15-.30; Cr. .80-1.10; Mo. .15-.25.	70	90	20-10	S, P, B.	B[1]	B[6]	D	195
196	U.S. Navy 46-S-1 (INT) Grade H.T. Welding	U.S. Steel Corp., Pittsburgh, Pa.	S. .05 max.; P. .04 max.; C. .18 max.; Mn. 1.45 max.; Si. .25 max.; Si. .25 max.; V. .08-.14; Cu. .25 max.	50	90 max.	25	HR, B, W.	A	D	D	196
197	U.S. Navy 48-S-5 Int.e Grade H.T. welding(d)	U.S. Steel Corp., Pittsburgh, Pa.‡	S. .050 max.; P. .040 max.; C. .18 max.; Mn. 1.45 max.; Si. .25 max.; Ni. .25 max.; V. .08-.14; Cu. .25 max.	50	90 max.	22	S, P, HR, CR, B.	A	D	D	197
198	U.S.S. 17	U.S. Steel Corp., Pittsburgh, Pa.	S. .030 max.; P. .030 max.; C. .12 max.; Mn. .75 max.; Si. .75 max.; Ni. .50 max.; Cr. 14-18.	40-55	70-90	30-20	S, P, HR, CR.	B[16]	B[16]	D	198
199	U.S.S. 17-7	U.S. Steel Corp., Pittsburgh, Pa.	S. .030 max.; P. .030 max.; C. .09-.20; Mn. 2.00 max.; Si. .75 max.; Ni. 7-9; Cr. 16-18.	75-140	125-185	20-3	S.	B[18]	B[18]	A	199
200	U.S.S. 18-8	U.S. Steel Corp., Pittsburgh, Pa.	S. .030 max.; P. .030 max.; C. .08-.20; Mn. 2.00 max.; Si. .75 max.; Ni. 8-10; Cr 17.50-20.	30-45	80-95	60-50	S, P, HR, CR.	B[18]	B[18]	A	200
201	U.S.S. 18-8S.	U.S. Steel Corp., Pittsburgh, Pa.	S. .030 max.; P. .030 max.; C. .08 max.; Mn. 2.00 max.; Si. .75 max.; Ni. 8-10; Cr. 18-20.	30-45	80-95	60-50	S, P, HR, CR.	A[18]	A[18]	A	201
202	U.S.S. 18-8 Mo.	U.S. Steel Corp., Pittsburgh, Pa.	S. .030 max.; P. .030 max.; C. .10 max.; Mn. 2.00 max.; Si. .75 max.; Ni. 14 max.; Cr. 16-18; Mo. 2-3.	30-45	80-95	60-50	S, P, HR, CR.	B[18]	B[18]	D	202

No.	Material	Manufacturer	Nominal Chemical Composition (Percent)	Yield Stgth.* 1,000 psi	Tensile Stgth.** 1,000 psi	Elongation % in 2 in.	Forms Available†	Welding Qualities‡‡			No.
								Arc	Gas	Resistance	
203	U.S.S. 18-8 Ti.	U.S. Steel Corp., Pittsburgh, Pa.	S. .030 max.; P. .030 max.; C. .10 max.; Mn. 2.00 max.; Si. .75 max.; Ni. 7-10; Cr. 17-20; Ti. 4xC min.	30-45	80-95	60-50	S, P, HR, CR.	A	A	A	203
204	U.S.S. 18-8Cb‡	U.S. Steel Corp., Pittsburgh, Pa.	S. .030 max.; P. .030 max.; C. .10 max.; Mn. 2.00 max.; Si. .75 max.; Ni. 8-12; Cr. 17-12; Cb. 10xC min.	35-50	80-100	55-45	S, P, HR, CR.	A	A	A	204
205	U.S.S. 25-12.	U.S. Steel Corp., Pittsburgh, Pa.	S. .030 max.; P. .030 max.; C. .20 max.; Mn. 2.00 max.; Si. .75 max.; Ni. 12-14; Cr. 22-26.	40-50	90-110	50-35	S, P, HR, CR.	B[18]	B[18]	A	205
206	Yoloy .10% Carbon	Youngstown Sheet & Tube, Youngstown, Ohio	S. .05; P. .04; C. .10; Mn. .40; Ni. 1.00 min.; Cu. .75 min.	50	70	35	S, P, CR, HR, B, W, T.	A	A	A[19]	206
207	Yoloy .15% Carbon	Youngstown, Sheet & Tube, Youngstown, Ohio.	S. .05; P. .04; C. .15; Mn. .65; Si. .15; Ni. 1.00 min.; Cu. .75 min.	56	77	30	S, P, CR, HR, B, W, T.	A	A	A[19]	207
208	Yoloy .20% Carbon	Youngstown Sheet & Tube, Youngstown, Ohio.	S. .05; P. .04; C. .20; Mn. .80; Si. .15; Ni. 1.00 min.; Cu. .75 min.	62	85	25	S, P, CR, HR, B, W, T.	A	A	A[19]	208

*Yield strength : that load which will produce an elongation of .002" in 1". The value is obtained from stress-strain curves, and is based on a 29,000,000 psi Modulus of Elasticity for steel, 6,500,000 psi for magnesium alloys, 10,300,000 psi for aluminum, 15,000,000 psi for brasses, 20,000,000 psi for 70/30 cupro-nickel.

**Single figure (50) indicates minimum value. Double figures (28-50) indicate range, which varies because of production processes or other causes; e.g., heat treatment, annealing, cold rolling, drawing, etc.

†Available forms: P=plates, S=sheets, CR=cold rolled, HR=hot rolled, B=bars, W=wire, T=tubing, R=rods.

‡‡Welding Qualities: A=Readily weldable. B=Weldable under favorable conditions (see footnotes). C=Not ordinarily weldable. D=No welding data available. X=This method of gas welding may be applied successfully to the chromium nickel and straight chromium alloys under certain conditions, but it is not as well adapted for general work with these alloys as is the metallic arc method. It is frequently employed on 20 gauge and lighter material.

‡Also available from Alan Wood Steel Co., Conshohocken, Pa.

a. Nickel Steel to A.S.T.M. Specs., b. Carbon Moly to A.S.T.M. Specs., c. Manganese Vanadium to A.S.T.M. Specs., d. Chrome Moly to U.S. Army or Navy Specs., e. Manganese Vanadium to U.S. Navy Specs.

t. Used as furnished.

1. The necessity for stress relief annealing usually depends on the character of part and service. Adequate preheat can confer practically the same metallurgical advantages as post heating. 2. Can be flash welded. 3. Preheat during welding is required; the temperature during welding should be suitable for the composition and thickness of the material. Special welding technique required also. 4. Annealing suggested to remove brittleness and to improve ductility. 5. Thin sections. 6. Post heat. 7. Unable to make ductile. 8. Preheat—cool slowly. 9. Low preheat 100-300 F is desired or recommended during welding. 10. Preheat during welding is required; the temperature during welding should be suitable for the composition and thickness of the material. 11. Low preheat 100-300 F is desired or recommended during welding in heavy sections. 12. Pickled surface required. 13. Heat treatment required. 14. Stress relieve after welding. 15. Impact strength increased by annealing. 16. Use austenitic rod; e.g., 17 CR rod annealed. 17. Annealed. 18. Annealing necessary for maximum resistance to corrosion. 19. Spot welding only.

This concludes the weldable ferrous alloys

On the pages to follow are listed the weldable non-ferrous alloys

WELDABLE ALLOY MATERIALS—NON-FERROUS

No.	Material	Manufacturer	Nominal Chemical Composition (Percent)	Yield Stgth. * 1,000 psi	Tensile Stgth. ** 1,000 psi	Elongation % in 2 in.	Forms Available†	Welding Qualities‡‡			No.
								Arc	Gas	Resistance	
209	Admiralty	(See Footnote‡.)	Zn. 28.; Pb. 0.075 max.; Sn. 1.0; Fe. 0.06 max.; Cu. 71.	16-20	40-50	65-55	S, P, SH, B, W, T.	B[1]	B[2]	B[3]	209
210	Alcoa 2S-0	Aluminum Co. of America, Pittsburgh, Pa.	Al. 99.6	5	13	35	S, P, SH, B, W, T, R.	A	A	A	210
211	Alcoa 2S-H	Aluminum Co. of America, Pittsburgh, Pa.	Al. 99.6	21	24	5	S, P, SH, B, W, T, R.	A	A	A	211
212	Alcoa 3S-0	Aluminum Co. of America, Pittsburgh, Pa.	Mn. 1.2; Al. rem.	6	16	30	S, P, SH, B, W, T, R.	A	A	A	212
213	Alcoa 3S-H	Aluminum Co. of America, Pittsburgh, Pa.	Mn. 1.2; Al. rem.	25	29	4	S, P, SH, B, W, T, R.	A	A	A	213
214	Alcoa 17S-0	Aluminum Co. of America, Pittsburgh, Pa.	Cu. 4.0; Mn. 0.5; Mg. 0.5; Al. rem.	10	26	20	S, P, SH, B, W, T, R, F.	C	C	B[4]	214
215	Alcoa 17S-T	Aluminum Co. of America, Pittsburgh, Pa.	Cu. 4.0; Mn. 0.5; Mg. 0.5; Al. rem.	40	62	20	S, P, SH, B, W, T, R, F.	C	C	B[4]	215
216	Alcoa 24S-0	Aluminum Co. of America, Pittsburgh, Pa.	Cu. 4.5; Mn. 0.6; Mg. 1.5; Al. rem.	10	26	20	S, P, SH, B, W, T, R.	C	C	B[4]	216
217	Alcoa 24S-T	Aluminum Co. of America, Pittsburgh, Pa.	Cu. 4.6; Mn. 0.6; Mg. 1.5; Al. rem.	45	68	19	S, P, SH, B, W, T, R.	C	C	B[4]	217
218	Alcoa 24S-RT	Aluminum Co. of America, Pittsburgh, Pa.	Cu. 4.6; Mn. 0.6; Mg. 1.5; Al. rem.	55	70	13	S, P, SH.	C	C	B[4]	218
219	Alcoa 52S-0	Aluminum Co. of America, Pittsburgh, Pa.	Cr. 0.25; Mg. 2.5; Al. rem.	14	29	25	S, P, SH, B, W, T, R.	A	A	A	219
220	Alcoa 52S-H	Aluminum Co. of America, Pittsburgh, Pa.	CR. 0.25; Mg. 2.5; Al. rem.	36	41	7	S, P, SH, B, W, T, R.	A	A	A	220
221	Alcoa 53S-0	Aluminum Co. of America, Pittsburgh, Pa.	Si. 0.7; Cr. 0.25; Mg. 1.3; Al. rem.	7	16	25	S, P, SH, HR, B, W, T, R, F.	A	A	A	221
222	Alcoa 53S-W	Aluminum Co. of America, Pittsburgh, Pa.	Si. 0.7; Cr. 0.25; Mg. 1.3; Al. rem.	20	33	22	S, P, SH, HR, B, W, T, R, F.	A	A	A	222
223	Alcoa 53S-T	Aluminum Co. of America, Pittsburgh, Pa.	Si. 0.7; Cr. 0.25; Mg. 1.3; Al. rem.	33	39	14	S, P, SH, HR, B, W, T, R, F.	A	A	A	223
224	Alcoa 61S-0	Aluminum Co. of America, Pittsburgh, Pa.	Cu. 0.25; Si. 0.6; Cr. 0.25; Mg. 1.0; Al. rem.	8	18	22	S, P, SH, HR, T.	A	A	A	224
225	Alcoa 61S-W	Aluminum Co. of America, Pittsburgh, Pa.	Cu. 0.25; Si. 0.6; Cr. 0.25; Mg. 1.0; Al. remainder	21	35	22	S, P, SH, T.	A	A	A	225
226	Alcoa 61S-T	Aluminum Co. of America, Pittsburgh, Pa.	Cu. 0.25; Si. 0.6; Cr. 0.25; Mg. 1.0; Al. remainder	39	45	12	S, P, SH, T.	A	A	A	226
227	Alclad 24S-T	Aluminum Co. of America, Pittsburgh, Pa.	Alcoa 24S-T with high-purity Al. coating	41	62	19	S, P.	C	C	A	227
228	Aluminum 2S-0	Sheet Aluminum Corp., Jackson, Mich.	Al. 99.6	5	13	35	S, P.	D	A	A	228
229	Aluminum 2S¼H	Sheet Aluminum Corp., Jackson. Mich,	Al. 99.6	13	15	12	S, P.	D	A	A	229
230	Aluminum 2S½H	Sheet Aluminum Corp., Jackson, Mich.	Al. 99.6	14	17	9	S, P.	D	A	A	230
231	Aluminum 2S¾H	Sheet Aluminum Corp., Jackson, Mich.	Al. 99.6	17	20	6	S, P.	D	A	A	231
232	Aluminum 2SH	Sheet Aluminum Corp., Jackson, Mich.	Al. 99.6	21	24	5	S, P.	D	A	A	232
233	Brass (70-30)	Revere Copper & Brass, Inc., New York	Zn. 30.; Pb. 0.05 max.; Fe. 0.05 max. Cu. 70.	13-17	40-50	55-45	S, P, HR, CR, B, W, T.	B[1]	B[2]	B[3]	233
234	Brass, High	Chase Brass & Copper Co., Inc. Waterbury, Conn.	Cu. 67; Zn. 33.	20	52	55	S, P, CR, B, W, T.	C	A	B[5]	234
235	Brass, Naval	(See Footnote ‡.)	Cu. 60; Zn. 39.25; Sn. 0.75.	30	55	40	S, P, CR, B.	B[1]	A	B[5]	235
236	Brass, Red	(See Footnote ‡.)	Cu. 85; Zn. 15.	14	42	47	S, P, CR, B, W, T.	B[1,5]	B[5,2]	C	236
237	Brass, Red, 85%	(See Footnote ‡.)	Cu. 85; Zn. 15;	15	40	45	S, P, CR, B, W, T.	C	B[6]	C[7]	237
238	Brass, Yellow	(See Footnote‡.)	Cu. 65; Zn. 35;	17	45	60	S, P, CR, B, W.	C	B[8]	C	238
239	Bronze, Commercial	(See Footnote‡.)	Zn. 10.; Pb. 0.03 max.; Fe. 0.05; Cu. 90	9-13	32-42	45-35	S, P, HR, CR, B, W, T.	B[1]	B[2]	C	239
240	Bronze, Roman	Revere Copper & Brass, Inc., New York	Zn. 39.25; Pb. 0.02 max.; Sn. 0.75; Fe. 0.05 max.; Cu. 60.	16-20	49-59	55-45	S, HR, CR, B, W, T.	B[1]	B[2]	B[3]	240

No.	Material	Manufacturer	Nominal Chemical Composition (Percent)	Yield Stgth.* 1,000 psi	Tensile Stgth.** 1,000 psi	Elongation % in 2 in.	Forms Available†	Welding Qualities‡‡			No.
								Arc	Gas	Resistance	
241	**Bronze, Manganese**	American Brass Company, (See Footnote‡.)	Cu. 59.; Zn. 39.0; Sn. 0.70; Mn. 0.50; Fe. 0.80	30	60	30	S, P, CR, HR, B, R.	C	B[8]	C	241
242	**Bronze, Tobin**	American Brass Co., Waterbury, Conn.	Cu. 60.0; Zn. 39.25; Sn. 0.75	22	56	45	S, P, CR, HR, B, W, R.	C	B[8]	C	242
243	Deoxidized Copper	(See Footnote ‡.)	Cu. 99.9; P. 0.02	10	33	35	S, P, CR, HR, B, W, T.	B[6,9]	B[6,10]	C	243
244	30% Cupro-Nickel	(See Footnote ‡.)	Cu. 70; Ni. 30.	22	55	40	S, P, CR, HR, B, W, T.	A	A	A	244
245	Cupro-Nickel 505	(See Footnote ‡.)	Pb. 0.05 max.; Fe. 0.5 max.; Cu. 80.; Ni. 20.; Mn. 0.75.	15-19	44-54	47-37	S, P, CR, B, W, T.	B[11]	B[12]	A	245
246	Dowmetal Ea	Dow Chemical Co., Midland, Mich.	Mn. 0.2; Al. 6.5; Mg. remainder	20	39	15	S, P, CR.	B[13]	A	A	246
247	Dowmetal Eh	Dow Chemical Co., Midland, Mich.	Mn. 0.2; Al. 6.5; Mg. remainder	34	45	9	S, P, CR.	B[13]	A	A	247
248	Dowmetal J-la	Dow Chemical Co., Midland, Mich.	Mn. 0.2; Al. 6.5; Zn. 1.0; Mg. remainder	24	42	16	S, P, CR, T	B[13]	B[14]	A	248
249	Dowmetal J-lh	Dow Chemical Co., Midland, Mich.	Mn. 0.2; Al. 6.5; Zn. 1.0; Mg. remainder	35	45	8	S, P, CR, T	B[13]	B[14]	A	249
250	Dowmetal Ma	Dow Chemical Co., Midland, Mich.	Mn. 1.5; Mg. remainder	18	34	18	S, P, CR, T	B[13]	A	A	250
251	Dowmetal Mh	Dow Chemical Co., Midland, Mich.	Mn. 1.5; Mg. remainder	27	37	9	S, P, CR, T	B[13]	A	A	251
252	Dowmetal O-1	Dow Chemical Co., Midland, Mich.	Mn. 0.2; Al. 8.5; Zn. 0.5; Mg. remainder	36	50	8	SH, B, R	B[13]	B[14]	A	252
253	Everdur 1010	American Brass Co., Waterbury, Conn.	Cu. 95.8; Mn. 1.1; Si. 3.1	20	55	60	S, P, CR, HR, B, W, T, F.	A	A	A	253
254	Everdur 1015	American Brass Co., Waterbury, Conn.	Cu. 98.25; Si. 1.50; Mn. .25.	15	40	45	S, P, HR, CR, B, W, T, R.	B[15]	B[16]	B[17]	254
255	Herculoy 418	Revere Copper & Brass, Inc., New York.	Si. 3.0; Pb. 0.02 max.; Sn. 0.5; Fe. 0.10 max.; Cu. rem.	22-26	55-65	70-60	S, P, HR, CR, B, W, T.	A[15]	A[16]	A[17]	255
256	Herculoy 419	Revere Copper & Brass, Inc., New York.	Si. 1.75; Pb. 0.02 max.; Sn. 0.25; Fe. 0.10 max.; Cu. rem.	20-24	40-50	70-60	S, P, HR, CR, B, W, T.	B[15]	B[16]	B[17]	256
257	Herculoy 420	Revere Copper & Brass, Inc., New York	Mn. 1.0; Si. 3.0; Pb. 0.02 max.; Fe. 0.10 max.; Cu. rem.	22-26	55-65	70-60	S, P, HR, CR, B, W, T	A[15]	A[16]	A[17]	257
258	Herculoy 421	Revere Copper & Brass, Inc., New York	Mn. 0.3; Si. 1.75; Pb. 0.02 max.; Fe. 0.10 max.; Cu. rem.	20-24	40-50	70-60	S, P, HR, CR, B, W, T.	B[15]	B[16]	B[17]	258
259	Hyblum AAO	Sheet Aluminum Corp., Jackson, Mich.	Mn. 0.12; Si. 0.45; Ni. 0.70; Cu. 0.23	11	20	25	S, P.	D	A	A	259
260	Hyblum AA¼H	Sheet Aluminum Corp., Jackson, Mich.	Mn. 0.12; Si. 0.45; Ni. 0.70; Cu. 0.23	22	24	6.5	S, P.	D	A	A	260
261	Hyblum AA½H	Sheet Aluminum Corp., Jackson, Mich.	Mn. 0.12; Si. 0.45; Ni. 0.70; Cu. 0.23	25	26	4	S, P.	D	A	A	261
262	Hyblum AA¾H	Sheet Aluminum Corp., Jackson, Mich.	Mn. 0.12; Si. 0.45; Ni. 0.70; Cu. 0.23	27	28	3	S, P.	D	A	A	262
263	Hyblum AAH	Sheet Aluminum Corp., Jackson, Mich.	Mn. 0.12; Si. 0.45; Ni. 0.70; Cu. 0.23	32	33	3	S, P.	D	A	A	263

*Yield strength is that load which will produce an elongation of .005″ in 1″. The value is obtained from stress-strain curves, and is based on a 25,000,000 psi Modulus of Elasticity for malleable iron, 6,500,000 psi for magnesium alloys, 10,300,000 psi for aluminum, 15,000,000 psi for brasses, 20,000,000 psi for 70/30 cupro-nickel.

**Single figure (50) indicates minimum value. Double figures (28-50) indicate range, which varies because of production processes or other causes; e.g., heat treatment, annealing, cold rolling, drawing, etc.

†Available forms: P=plates, S=sheets, SH=rolled or extruded shapes, CR=cold rolled, HR=hot rolled, B=bars, W=wire, T=tubing, R=rods, F=forgings.

‡‡Welding Qualities: A=readily weldable. B=weldable under favorable conditions (see footnotes). C=not ordinarily weldable. D=no welding data available. E=welding in experimental stage.

‡Available from American Brass Co., Chase Brass and Copper Co., and Revere Copper and Brass, Inc.

1. Carbon arc: play on zinc free filler rod of silicon or phosphor bronze types; 700-1000 F. preheat desirable for heavier gauges. 2. Slightly oxidizing flame desirable with filler rods or strips of base metal composition, or with "bronze" welding rods. 3. Accurate control over pressure, time and heat necessary. 4. Mild corrosion conditions only. 5. Consult producer. 6. High heat required. 7. A special high silicon red brass having an "A" rating for resistance spot and seam welding is available. 8. Oxidizing flame. 9. Metallic arc: coated electrode and 700-900 F. preheat. Carbon arc: silicon or phosphor bronze filler rods and 500-900 F. preheat. 10. Adequate preheat and deoxidized filler rod. 11. Coated cupro-nickel electrodes. 12. Usually employed for thinner gauges; reducing flame necessary to prevent formation of refractory nickel oxide; flux recommended. 13. Weldable in a helium atmosphere. 14. Limited to simple structures. 15. Carbon arc: silicon bronze filler rods; flux necessary; arc length and manipulation of carbon electrode both important. 16. Slightly oxidizing flame recommended; flux necessary; "hot shortness" of alloys necessitates care to prevent cracking of "closed structure" type welds. 17. Surface must be free of silicon oxide; accurate control over variables necessary. 18. Preheating. 19. Limited to comparatively thin sections. 20. Applies to spot welding. Seam welding is also satisfactory but as yet in little commercial use. Butt welding is limited to comparatively simple shape. 21. Comparatively short seams only. 22. Metallic arc: coated electrodes; preheat necessary in medium and heavy thicknesses. Carbon arc: phosphor bronze filler rods; arc length important—long arc preferred. 23. Carbon or coated metal arc. 24. Must reheat treat.

No.	Material	Manufacturer	Nominal Chemical Composition (Percent)	Yield Stgth. * 1,000 psi	Tensile Stgth. ** 1,000 psi	Elongation % in 2 in.	Forms Available†	Welding Qualities‡‡			No.
								Arc	Gas	Resistance	
264	Hyblum BO	Sheet Aluminum Corp., Jackson, Mich.	Mn. 0.05; Si. 0.45; Ni. 0.30; Cu. 0.10	8.6	16	25	S, P.	D	A	A	264
265	Hyblum B¼H	Sheet Aluminum Corp., Jackson, Mich.	Mn. 0.05; Si. 0.45; Ni. 0.30; Cu. 0.10	17	21	9	S, P.	D	A	A	265
266	Hyblum B½H	Sheet Aluminum Corp., Jackson, Mich.	Mn. 0.05; Si. 0.45; Ni. 0.30; Cu. 0.10	20	22	5	S, P.	D	A	A	266
267	Hyblum B¾H	Sheet Aluminum Corp., Jackson, Mich.	Mn. 0.05; Si. 0.45; Ni. 0.30; Cu. 0.10	23	25	3	S, P.	D	A	A	267
268	Hyblum BH	Sheet Aluminum Corp., Jackson, Mich.	Mn. 0.05; Si. 0.45; Ni. 0.30; Cu. 0.10	26	27	2	S, P.	D	A	A	268
269	Hyblum DO18	Sheet Aluminum Corp., Jackson, Mich.	Mn. 0.16; Si. 0.45; Ni. 1.00; Cu. 0.32; Mg. 0.40	37	43	12	S, P.	D	A	A	269
270	Illium "R" (Annealed)	Burgess-Parr Company, Freeport, Illinois	C. 0.2 max.; Mn. 1-2; Si. 0.65 max.; Ni. 55-58; Cr. 22-24; Cu. 3-7; Mo. 5-7; Fe. 5-7	45-55	95-105	30-45	S, P, CR, HR, B, W, T, R	A	B[18]	A	270
271	Illium "R" (Work Hardened)	Burgess-Parr Company, Freeport, Illinois	C. 0.2 max.; Mn. 1-2; Si. 0.65 max.; Ni. 55-58; Cr. 22-24; Cu. 3-7; Mo. 5-7; Fe. 5-7	60-100	105-150	12-3	S, P, CR, HR, B, W, T, R	A	B[18]	A	271
272	Inconel	International Nickel Co., Inc., New York.	S. 0.015; C. 0.08; Mn. 0.25; Si. 0.25; Ni. 79.5; Cr. 13.0; Cu. 0.2; Fe. 6.5	30-45	80-100	50-35	S, P, CR, HR, B, W, T, R.	A	A	A	272
273	Inconel Clad Steel	Lukens Steel Co., Coatesville, Pa.	Ni. 79.5; Cr. 13; Fe. 6.5; Mn. 0.25; Si. 0.25; C. .08; Cu. .20	50	55-65	30	S, P, HR.	A	C	B[19]	273
274	Mazlo AM3S	American Magnesium Corp., Cleveland, O.	Mn. 1.5; Mg. remainder	17-27	32-36	16-5	S, P, SH, CR, HR, B, W, T, F.	B[13]	A	A[20]	274
		American Magnesium Corp., Cleveland, O.	Mn. 0.2; Al. 3.0; Zn. 1.0; Mg. remainder	25-34	38-46	18-10	S, P, SH, CR, HR, B, W, T.	B[13]	A	A[20]	
275	Mazlo AM-C52S	American Magnesium Corp., Cleveland, O.	Mn. 0.2; Al. 3.0; Zn. 1.0; Mg. remainder	25-34	38-46	18-10	S, P, SH, CR, HR, B, W, T.	B[13]	A	A[20]	275
276	Mazlo AM-C57S	American Magnesium Corp., Cleveland, O.	Mn. 0.2; Al. 6.5; Zn. 0.9; Mg. remainder	26-35	42-50	10-6	S, P, SH, CR, HR, B, T, F.	B[13]	B[21]	A[20]	276
277	Monel	International Nickel Co. New York, N. Y.	S. 0.01; C. 0.15; Mn. 1.0; Si. 0.1; Ni. 67.0; Cu. 30.0; Fe. 1.4	25-45	65-85	50-20	S, P, CR, HR, B, W, C, T, R	A	A	A	277
278	Monel Clad Steel	Lukens Steel Co., Coatesville, Pa.	Ni. 67.; Cu. 30.; Fe. 1.4; Mn. 1.0; C. 0.15; Si. 0.1	50	55-65	30	S, P, HR.	A	C	B[19]	278
279	Muntz Metal	(See Footnote ‡.)	Zn. 40.; Pb. 0.30 max.; Fe. 0.07 max.; Cu. 60.	13-17	52-62	53-43	S, P, HR, CR, B, W, T.	B[1]	B[2]	B[3]	279
280	Nickel	International Nickel Co., New York, N. Y.	S.005; C. 0.1; Mn. 0.2; Si. 0.05; Ni. 99.4; Cu. 0.1; Fe. 0.15	15-30	60-80	50-35	S, P, CR, HR, B, W, C, T, R.	A	A	A	280
281	Nickel Clad Steel	Lukens Steel Co., Coatesville, Pa.	Ni. 99.4; C. 0.1; Cu. 0.1; Fe. 0.15; Mn. 0.2; Si. 0.05	50	55-65	30	S, P, HR.	A	C	B[19]	281
282	Olympic Bronze, Type A	Chase Brass & Copper Co., Inc., Waterbury, Conn.	Si. 3.0; Cu. 96.0; Zn. 1.0	20	55	65	S, P, CR, B, W, T.	A	A	A	282
283	Olympic Bronze, Type B	Chase Brass & Copper Co., Waterbury, Conn.	Si. 1.5; Cu. 97.5; Zn. 1.0;	16	45	40	S, W, T.	A	A	A	283
284	Phosphor Bronze "A"	Revere Copper & Brass, Inc., New York	P. 0.2; Pb. 0.05 max.; Sn. 5.; Fe. 0.05 max.; Cu. 95.	18-22	45-55	60-50	S, P, CR, B, W.	B[22]	C	A	284
285	5% Phosphor Bronze	American Brass Co., Waterbury, Conn.	Cu. 95.0; Sn. 5.0;	20	48	50	S, P, CR, HR, B, W, R.	B[23]	C	B	285
286	Pure Clad 24SO	Reynolds Metals Co., Louisville, Ky.	Reynolds 24SO, high purity Al. coating	33	56	18	S, P.	D	B[24]	A	286
287	Pure Clad 24ST	Reynolds Metals Co., Louisville, Ky.	Reynolds 24ST, high purity Al. coating	41	62	18	S, P.	D	B[24]	A	287

No.	Material	Manufacturer	Nominal Chemical Composition (Percent)	Yield Stgth. * 1,000 psi	Tensile Stgth. ** 1,000 psi	Elongation % in 2 in.	Forms Available†	Welding Qualities‡‡			No.
								Arc	Gas	Resistance	
288	**Reynolds 2SO**	**Reynolds Metals Co., Louisville, Ky.**	Al. 99.0 (min)	5	13	35	S, P, SH, B, W, R, T.	D	A	A	288
289	**Reynolds 2S½H**	**Reynolds Metals Co., Louisville, Ky.**	Al. 99.0	14	17	9	S, P, W, T.	D	A	A	289
290	**Reynolds 2SH**	**Reynolds Metals Co., Louisville, Ky.**	Al. 99.0	21	24	5	S, P.	D	A	A	290
291	Reynolds 3SO	Reynolds Metals Co., Louisville, Ky.	Mn. 1.2; Al. remainder	6	16	30	S, P, SH, B, W, R, T.	D	A	A	291
292	**Reynolds 3S½H**	**Reynolds Metals Co., Louisville, Ky.**	Mn. 1.2; Al. remainder	18	21	8	S, P, W, T.	D	A	A	292
293	Reynolds 24SO	Reynolds Metals Co., Louisville, Ky.	Cu. 4.5; Mg. 1.5; Mn. 0.6; Al. remainder	10	26	20	S, P, SH, B, W, T.	D	B[24]	B[4]	293
294	Reynolds 24ST	Reynolds Metals Co., Louisville, Ky.	Cu. 4.5; Mg. 1.5; Mn. 0.6; Al. remainder	45	68	19	S, P, SH, B, W, T.	D	B[24]	B[4]	294
295	Reynolds 52SO	Reynolds Metals Co., Louisville, Ky.	Mg. 2.5; Cr. 0.25; Al. remainder	14	29	25	S, P, SH, B, W, T.	D	A	A	295
296	Reynolds 52S¼H	Reynolds Metals Co., Louisville, Ky.	Mg. 2.5; Cr. 0.25; Al. remainder	26	34	12	S, P, W, T.	D	A	A	296
297	Reynolds 52S½H	Reynolds Metals Co., Louisville, Ky.	Mg. 2.5; Cr. 0.25; Al. remainder	29	37	10	S, P, W, T.	D	A	A	297
298	**Reynolds 61SO**	**Reynolds Metals Co., Louisville, Ky.**	**Cu. 0.25; Mg. 1.0; Si. 0.6; Cr. 0.25; Al. remainder**	8	18	22	S, P, SH, B, W, R, T.	D	A	A	298
299	Reynolds 61SW	**Reynolds Metals Co., Louisville, Ky.**	Cu. 0.25; Mg. 1.0; Si. 0.6; Cr. 0.25; Al. remainder	21	35	22	S, P, SH, B, W, R, T.	D	A	A	299
300	**Reynolds 61ST**	**Reynolds Metals Co., Louisville, Ky.**	Cu. 0.25; Mg. 1.0; Si. 0.6; Cr. 0.25; Al. remainder	39	45	12	S, P, HS, B, W, R, T.	D	A	A	300
301	**Super Nickel Clad Steel**	**Lukens Steel Co., Coatesville, Pa.**		50	55-56	30	S, P, HR.	A	C	B[19]	301

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†Available forms: P=plates, S=sheets, SH=rolled or extruded shapes, CR=cold rolled, HR=hot rolled, B=bars, W=wire, T=tubing, R=rods, F=forgings.

‡‡Welding Qualities: A=readily weldable. B=weldable under favorable conditions (see footnotes). C=not ordinarily weldable. D=no welding data available. E=welding in experimental stage.

‡Available from American Brass Co., Chase Brass and Copper Co., and Revere Copper and Brass, Inc.

1. Carbon arc: play on zinc free filler rod of silicon or phosphor bronze types; 700-1000 F. preheat desirable for heavier gauges. 2. Slightly oxidizing flame desirable with filler rods or strips of base metal composition, or with "bronze" welding rods. 3. Accurate control over pressure, time and heat necessary. 4. Mild corrosion conditions only. 5. Consult producer. 6. High heat required. 7. A special high silicon red brass having an "A" rating for resistance spot and seam welding is available. 8. Oxidizing flame. 9. Metallic arc: coated electrode and 700-900 F. preheat. Carbon arc: silicon or phosphor bronze filler rods and 500-900 F. preheat. 10. Adequate preheat and deoxidized filler rod. 11. Coated cupro-nickel electrodes. 12. Usually employed for thinner gauges; reducing flame necessary to prevent formation of refractory nickel oxide; flux recommended. 13. Weldable in a helium atmosphere. 14. Limited to simple structures. 15. Carbon arc: silicon bronze filler rods; flux necessary; arc length and manipulation of carbon electrode both important. 16. Slightly oxidizing flame recommended; flux necessary; "hot shortness" of alloys necessitates care to prevent cracking of "closed structure" type welds. 17. Surface must be free of silicon oxide; accurate control over variables necessary. 18. Preheating. 19. Limited to comparatively thin sections. 20. Applies to spot welding. Seam welding is also satisfactory but as yet in little commercial use. Butt welding is limited to comparatively simple shape. 21. Comparatively short seams only. 22. Metallic arc: coated electrodes; preheat necessary in medium and heavy thicknesses. Carbon arc: phosphor bronze filler rods; arc length important—long arc preferred. 23. Carbon or coated metal arc. 24. Must reheat treat.

ACKNOWLEDGMENT. THE WELDING ENGINEER wishes to thank the various companies whose names appear as a part of this survey for the information and courtesies extended to its editors in the collecting of this material. All information on the chemical, mechanical and welding properties are made on the authority of the manufacturers to whom questionnaires were submitted.

On the Job

Welding a Wheel Chair

USING arc welding equipment, E. Cunningham, Vancouver, B. C., weldor, was able in four nights to construct a unique tricycle wheel chair for a man with the misfortune to have both legs taken off at the knees.

Cunningham made the chair out of bicycle wheels and sprockets plus several lengths of ¾ in. black iron pipe. The entire cost was $30. The overall length is 63 in. and the width 32 in. The chair has two bicycle wheels in the front, one in the rear. It is driven by hand cranks and steered by a block which rests against the shoulders of the person sitting in the vehicle.

Photo by The Lincoln Electric Co.

Rear view of arc welded wheel chair built by E. Cunningham of Vancouver, British Columbia.

Nine welds had to be made on each side and four in the front. Half circles were cut in the pipe ends; the ends were then clamped together and held for butt welding.

Construction details are shown in the accompanying picture. Note first that the front fork of a bicycle supports the front wheel. Four pipes, each 18½ in. long, extend at angles from either side of the front fork and are attached to the two vertical columns from which the front framework is extended.

The rear wheels are also supported by bicycle forks and are shielded by bicycle mud guards. The angular portions of the forks were welded to the vertical columns of the chair. A board of thick plywood was bolted to the horizontal cross pipes, front and rear, in order to provide a rest for the seat cushion.

Photo by Hobart Brothers

Tungsten-gold placer mill a job shop weldor built for a mine near Johannesburg, Calif.

Welding Mine Equipment

BECAUSE OF the critical shortage of metals and metal products today existing in the United States, the mining industry has turned to welding as an efficient, economical means of constructing special and standard equipment. Above is pictured a placer mill manufactured for less than $300. This machine was constructed right on the mine site and built to the exact specifications of the mine's engineers.

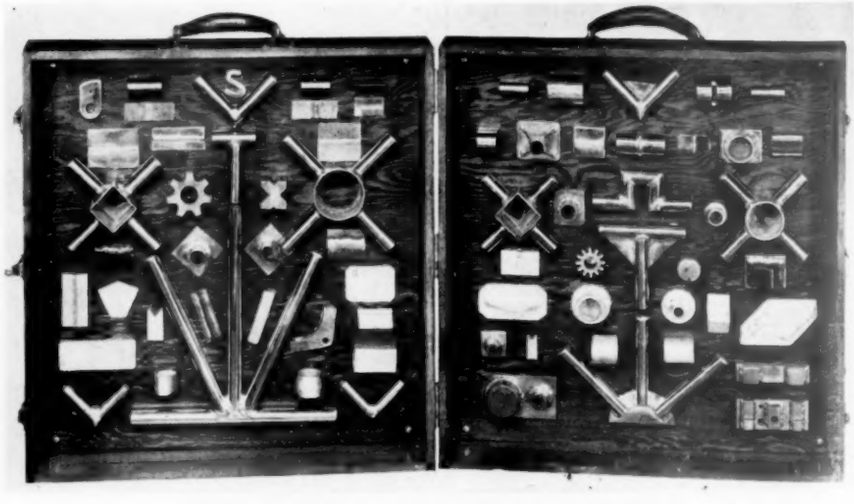
Welded Valve Guard

By C. C. LYNDE

PROTECTION for the valves and outlet connections on the butane gas tank used with an oil well drilling unit was provided in simple fashion by a ring of light tank steel high enough to extend beyond the connections. The attachment to the tank head was made through four angle-iron struts because of the change in expansion rates between head and guard, which would have been restricted by the presence of a circular weld. The struts were provided with feet which were welded to the tank, and the circular valve guard was then welded to the edges of these supports.

The aperture between the base of ring and the tank head permitted dissipation of any gas which might happen to leak through the valves. Such gas, confined in a tight pocket, might be able to cause a disastrous explosion.

This welded steel ring provided ample protection for the butane gas tank's valves.



Acetylene (left) and arc welded samples made by Gordon McNab of Detroit to show what can be done with welding.

New Products of 1942

A ready reference file of the 133 products announced in THE WELDING ENGINEER since the last Metal Show issue.

A-C Welders

US Protected Arc Welder. Featuring a single dial for simpler control, this A-C welder has 60 heat step selections from 20 to 350 amp. US Electric Welder Corp., Toledo, O. **November, 1941.**

» «

Marquette 160 Series. These are welders of the transformer type, available in four models. Model 160 has an amperage range of from 20 to 125 amp; Model 161 a range of 20 to 175 amp; Model 162 a range from 20 to 250 amp. Model 162T is the same as Model 162 except that it is mounted on a heavy duty truck with a crane eye attached to the top. All models are designed for 220 volts. Marquette Mfg. Co., Inc., Minneapolis. **November, 1941.**

» «

Glenn-Roberts 45-H Dual. This welder is designed for heavy duty operation in either single or dual circuit manual welding or with an automatic welding head. It has a current range of 50 to 570 amp on a single welding line or 50 to 300 amp on each of two lines. Glenn-Roberts Co., Oakland, Calif. **December, 1941.**

» «

Marquette 100 BB and 200 BB. Designed for heavy duty operation, the Model 100 BB has an amperage range from 20 to 150, while the 200 BB ranges from 20 to 200 amp. Both models are standard for 220 volts. Marquette Mfg. Co., Minneapolis. **December, 1941.**

» «

Larkin 75G, 150G and 250G. Model 75G is a 75 amp welder for the small shop where only 110 v, 60 cycle and 30 amp fuses are available. Models 150G and 250G are 150 amp and 250 amp welders, respectively. All models have amperage glide control, making available to the operator continuous amperage output. Larkin Lectro Products Corp., Brooklyn. **February, 1942.**

» «

Glenn-Roberts 55-S. A transformer-type welder said to be so designed as to supply a stable arc current under continuous control for Unionmelt and other automatic head welding. It operates on 220-440 v, 60 cycle, single phase current and has a rated output range of 400 to 800 amp, with a maximum output of 1,100 amp. Glenn-Roberts Co., Oakland, Calif. **February, 1942.**

» «

Dialarc. One of the outstanding features of this welder is that any desired heat can be selected by the turn of a dial. It is offered in two models: Model K200, 15 to 230 amp, and Model K300, 15 to 360 amp. The open circuit voltage (80 v) is claimed to be constant from the lowest to the highest heats. Shober Sales, Inc., Stockton, Calif. **February, 1942.**

» «

US Protected Arc Welder. This is a transformer-type welder with eight coils, featuring more than 60 heat selections from 20 to 350 amp. Combination heat and voltage adjustments are said to permit welding anything from 20 or 22 gauge sheets up to heavy locomotive frames and parts. US Electric Welder Corp., Toledo. **July, 1942.**

» «

Ergolyte 250 F. A heavy-duty, air-cooled arc welder which operates on 60-cycle, single phase current, 230 v, and has a current range from 15 to 250 amp, with 24 heat steps. Ergolyte Mfg. Co., Philadelphia. **July, 1942.**

» «

Brazing Units

Acro Incandescent Carbon Brazing Machine. This is a self-contained unit suitable for use with either 200 or 440 v power supply. By means of a special electronic timing device, cooling water circulates through the transformer, cable and tongs, while a thermostat mounted in the water supply tank renders operation fully automatic. Acro Welder Mfg. Co., Milwaukee. **October, 1941.**

» «

Ajax-Northrup 6 Kw. This high frequency self-contained unit was specially designed for brazing 2-lb bombs. It can, however, be converted for melting alloys, sintering carbide tools, experimental heating, or other forms of brazing, states manufacturer. Ajax Electrothermic Corp., Trenton, N. J. **March, 1942.**

» «

Butt Welding Attachment

Universal Butt Welding Attachment. This is a conversion unit by means of which any rocker arm type spot welder may be converted into a butt welder. No cables or rods are needed as the entire operation is automatically carried out by motion of the upper arm. Universal Power Corp., Cleveland. **October, 1941.**

Cable Connectors

Rapid Cable and Terminal Connector. This cable connector meets Navy requirements and conforms to Navy specifications. It features a positive locking device and is designed to provide rapid connection of welding cable. Chicago Tool and Engineering Co., Chicago. **June, 1942.**

» «

Burndy Hyclasp. A separable coupler for wires and cables which can be supplied for Navy, standard, flexible and extra flexible cable in sizes from No. 4 Stranded to 1,000,000 cir mil. Burndy Engineering Co., New York City. **September, 1942.**

» «

Chuck

Collet Chuck. A compact, single purpose collet chuck which can be attached quickly to hand-pieces used on Stow flexible shaft machines. Stow Mfg. Co., Inc., Binghamton, N. Y. **October, 1941.**

» «

Clamps

Twistite Ground C Clamp. Advantage of this clamp, states manufacturer, is that it provides a C clamp for holding the work as well as a positive ground connection for holding the cable securely. Michigan Clamp Co., Jackson, Mich. **October, 1941.**

» «

Knu-Vise 830 Midget Toggle Clamp. Though the Model 830 measures but 4 in. by 1½ in., it is claimed that a pressure of over 500 lb may be obtained with it. Adapted to aircraft work. Knu-Vise, Inc., Detroit. **November, 1941.**

» «

Pivoted Clamp. A clamp which incorporates the standard clamp principles with an additional vise feature. The latter is said to eliminate all surface movement of the clamp or material under pressure. Grand Specialties Co., Chicago. **January, 1942.**

» «

Vac-U-Clamp. A vacuum-type clamp designed to clamp stiffeners or other items tightly to plates so that close fit-ups are obtained for welding. It includes two rubber gasketed disc "feet" 18 in. in diam which are held in place by a vacuum maintained by a motor-driven pump. Glenn-Roberts Co., Oakland, Calif. **February 1942.**

De-Sta-Co Toggle Clamp. A light duty, horizontal style toggle clamp which has a pressure ratio of 50 to 1. Measures 8 11/32 in. across, 2 5/16 in. overall and 1 3/8 by 2 1/16 in. at the base. Detroit Stamping Co., Detroit. **April, 1942.**

» «

Quikcet. A fulcrum leverage speed clamp. Case hardened casting contacts viselike tightening screw, with fulcrum action providing downward pressure on work. Side screw tightening permits clamping in close quarters and also quick release. Grand Specialties Co., Chicago. **April, 1942.**

» «

De-Sta-Co Toggle Clamp 205. A small-size, horizontal-type toggle clamp designed for aircraft work. When in locked position, it measures 1 5/16 in. high and 5 1/4 in. from tip of handle to tip of arm. Detroit Stamping Co. **May, 1942.**

» «

Heavy-Duty C Clamp. Non-skid features are claimed for this "different" type of C clamp. Clamp tip is equipped with a bronze bushing in which the end of the heat-treated steel screw rotates. This bushing prevents galling and provides a free movement so that slippage on the work is prevented. Patterson-Ballagh Corp., Los Angeles. **June, 1942.**

» «

Crater Eliminators

Allis-Chalmers, Types A and **B.** This crater eliminator is designed for use on Weld-O-Tron low current arc welders. Type A is a portable unit which may be located near the welder. Type B is mounted with its motor on the back panel of the welder. Either eliminator is suitable for the 40 or 75 amp Weld-O-Tron. Both will operate on 110 or 120 v, 50 or 60 cycle current. Allis-Chalmers Mfg. Co., Milwaukee. **February, 1942.**

» «

Arctrol. A foot-operated, variable resistance unit designed to vary the excitation current of practically all standard D-C arc welders. Generator output may be regulated from full-rated current down to snuffing it out completely, states manufacturer. Mullenbach Electrical Mfg. Co., Los Angeles. **May, 1942.**

» «

G-E DL-8020711G1. For use with the G-E Strikeasy single operator arc welder, this crater filler is designed to provide very close auxiliary control of heat and to permit tapering off of the welding current at the end of bead. It is not intended to replace the control unit on the welder but it is to be used only to increase or decrease the heat setting to accommodate abnormal conditions at the beginning or end of a weld. General Electric Co., Schenectady, N. Y. **September, 1942.**

Cutting Tips

Airco 45. A high speed machine cutting tip which features a nozzle with a divergent exit portion. This tip design makes it possible to eject a narrow, high velocity stream of oxygen and is said to make it possible to increase the cutting speed of a machine torch from 20 to 30%. Air Reduction Sales Co., New York City. **February, 1942.**

» «

Airco 108. This tip is bent in an offset shape to meet the problem of cutting in close quarters. It has two preheat flames and is suitable for either machine or hand cutting. Available in sizes Nos. 1 to 3 for cutting steel up to 1½ in. thick. Air Reduction Sales Co., New York City. **June, 1942.**

» «

Airco 139. A straight tip with one preheat orifice, particularly adapted to splitting angle iron, straight-line cutting using a straight edge as a guide, or sheet metal cutting operations in which a light preheat is desired. Available in sizes Nos. 0 to 3. Air Reduction Sales Co., New York City. **June, 1942.**

» «

Cylinder Truck

GAR-BRO Acetylene Tank Cart. This truck has a total width of only 24 in., enabling it to pass through narrow passages. Chassis is mounted on two large pneumatic-tired wheels. Acetylene is at front and oxygen at rear of cart; either cylinder may be removed independently. Garlinghouse Brothers, Los Angeles. **November, 1941.**

» «

D-C Welders

G-E Strikeasy. A 150-amp arc welder for use in fabricating bright-surfaced, thin-gauge metals such as aircraft tubing (SAE-4130). Extra high instantaneous recovery of voltage (40 to 60 v) is said to help the operator to strike an arc with ease under the difficulties presented by thin metals having a bright, polished surface. General Electric Co., Schenectady, N. Y. **November, 1941.**

» «

P&H-Hansen, WN-150 and **WN-200.** These are portable gas-driven welder units with capacities of 15 to 200 amp and 30 to 260 amp, respectively. They are equipped with P&H-Hansen self-contained welding generators, powered by a direct connected 4-cycle, 4-cylinder gasoline engine, and mounted on pneumatic-tired trailers designed for towing at normal traffic speeds. The Harnischfeger Corp., Milwaukee. **January, 1942.**

» «

Flexarc. This welder features a means of current adjustment obtained by a ball crank, making it possible, claims manufacturer, to preset the desired current before starting to weld and eliminating the need for a field rheostat exciter and external reaction. Welder is available in 200, 300 or 400 amp, for 220, 440 or 550 v, two or three phase, 25, 50 or 60 cycle current. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. **January, 1942.**

» «

Lincoln Engine-Driven Welder. This welder has a current range of 40 to 250 amp and is specially designed for job welding and garage work. It is powered by a Hercules industrial engine and is equipped with "dual continuous control," enabling variation independently of both open circuit voltage and welding current. The Lincoln Electric Co., Cleveland. **February, 1942.**

» «

Electric Drills

UI4FS Aircraft Drills. Of small size and compact design, these ¼ in. drills are available in three different speeds and have side switch style handle for either continuous or intermittent drilling. Independent Pneumatic Tool Co., Chicago. **October, 1941.**

» «

Skildril. A compact, light weight ¼ in. drill for tight spots. It weighs only 2¾ lb, is 6⅝ in. overall and 2 5/16 in. wide. Drilling capacity in steel is ¼ in; in hardwood ½ in. Skilsaw, Inc., Chicago. **January, 1942.**

» «

Drill Extensions. These flexible shaft drill extensions are equipped with 45 and 90 deg heads and may also be obtained with a straight spindle. Stow Mfg. Co., Inc., Binghamton, N. Y. **May, 1942.**

» «

Electric Furnaces

Falcon. Box-type and muffle-type furnaces which may be used for testing of metal samples, for heating of high speed steels in tool rooms, for hardening and tempering operations, etc. Temperatures up to 2300 F may be attained. H. O. Swoboda, Inc., New Brighton, Pa. **February, 1942.**

» «

Falcon BWM. This latest addition to the Falcon line was designed primarily for fritting and glazing ceramics at temperatures up to 2000 F, but it is also claimed to be efficient for heat treating high speed tool steels, hardening, tempering, etc. H. O. Swoboda, Inc., New Brighton, Pa.

» «

Electric Shears

Lectro-Shear, 16 and **18.** No. 16 shear cuts up to 16 gauge sheet steel; No. 18 up to 18 gauge. Both models have been redesigned to improve ease of handling and operating characters. Black & Decker Mfg. Co., Towson, Md., **August, 1942.**

New PAGE ELECTRODE FOR ARMOR WELDING HELPS GET TANKS INTO ACTION!

A new electrode for welding armor was developed exclusively by **PAGE** *to cooperate with the change-over to welded tank production. It met all ballistic tests on plates submitted to the Army Ordnance Department by the tank manufacturers—and then went into action, having a real part in the great records that since have been set on welded tank production lines.*

It is worthwhile to note that, in spite of the pressure for speed, tank welders have been well schooled in technique that wastes no electrode—gets maximum strength with the use of no unnecessary metal in the weld—uses every electrode right down to the holder. All users of welding rod would do well to insist on their men observing such economy today.

PAGE WELDING ELECTRODES

PAGE STEEL AND WIRE DIVISION
Monessen, Pa., Atlanta, Chicago, New York, Pittsburgh, San Francisco
AMERICAN CHAIN & CABLE COMPANY, INC.
BRIDGEPORT, CONNECTICUT

In Business for Your Safety

Photo by U. S. Army Signal Corps

Electrode Holders

Jackson. The Jackson line, which comprises ten models ranging in capacity from 200 to 500 amp, has been changed in design to incorporate a rod bender with each model of electrode holder. Jackson Products, Detroit. **January, 1942.**

» «

Hol-Grip Jr. This holder is fully insulated, weighs but 8 oz, and is designed for a capacity of 150 amp when using No. 4 welding cable. It is capable of receiving electrodes from $\frac{1}{16}$ to $\frac{5}{32}$ in. in diam. Tweco Products Co., Wichita, Kansas. **January, 1942.**

» «

Hol-Tite. A new line of electrode holders for 300, 400 or 500 amp. Chief features are the positive vice-grip on electrode, replaceable jaws and no-spring construction. Hol-Tite Corp., Herrin, Ill. **February, 1942.**

» «

Engine Governor

Candee-Smith Governor. A unit for the control of converted auto and truck engines which are used for the driving of welding generators. It is claimed that it will accurately control and govern power output, resulting in fuel savings and a reduction in the maintenance cost of the welding generator. Candee's Machine Shop, Los Angeles. **December, 1941.**

» «

Finger Guards

Steel-Grip 14169. A light weight finger guard made of tough leather in front and flexible elastic at the back. The leather gives protection, while the elastic holds the guard in place and is porous for ventilation. Industrial Gloves Co., Danville, Ill. **December, 1941.**

» «

Steel-Grip Triplex. This guard is a protector for the thumb and first two fingers. It may be obtained in either wool felt or chrome leather, with back of elastic webbing, and can be purchased in pairs, all rights, all lefts or other combinations as needed. Industrial Gloves Co., Danville, Ill. **June, 1942.**

» «

Fire Extinguisher

Magout Powder. This powder is said to smother instantly fires caused by magnesium shavings in machine shops or by magnesium incendiary bombs. It is a non-absorbent, finely pulverized powder, available in either bulk quantities or in spiral-shaped cardboard containers. Pulmosan Safety Equipment Corp., Brooklyn. **May, 1942.**

» «

First Aid

M.S.A. Stretcher and Splint. A folding stretcher for the first aid room and a wood traction splint for use in supporting fractures of the arms or legs according to the accepted traction methods of the American Red Cross. Mine Safety Appliances Co., Pittsburgh, **May, 1942.**

» «

Flexible Shaft Units

Stow. These heavy duty units are direct drive and are supplied with 45 deg and 90 deg heads. If desired, the head may be removed and fitted directly into a drill chuck without using the flexible shafting. Stow Mfg. Co., Inc., Binghamton, N. Y. **June, 1942.**

» «

Floodlight

Carbide Floodlight, NC-200. This unit, said to be the largest now being manufactured, has two 8,000 cp floodlights constructed on swing joints, thereby allowing independent directional control with 16,000 cp concentration of light. National Carbide Corp., New York City. **July, 1942.**

» «

Fluxes

Fluxine Hard-Facing Compound. A flux for use in hard-facing of tool shanks, hammer heads, drill bits, etc., also suitable for tempering carbon steels. It is claimed that when this flux is used with ordinary cast iron welding rod deposited by the electric arc process, it will produce a surface having a hardness between 68 and 72 Rockwell C. Krembs & Co., Chicago. **December, 1941.**

» «

Fluxined-Spelter. This flux is for joining carbide and other types of cutting tips and blades to tool shanks. Flux is brushed on the contacting surfaces of both the cutting tip and tool shank; the work is then assembled to form a tight fit and brazed by either furnace, torch or spot-welding methods. Krembs & Co., Chicago. **July, 1942.**

» «

National Welding and Brazing Fluxes. A line of welding fluxes for both ferrous and non-ferrous metals. No. 1 is for welding cast iron, No. 2 a cast iron brazing flux, No. 3 a brazing flux suitable for brass, bronze, copper, steel and malleable iron and No. 22 an aluminum flux for sheet, cast, wrought and aluminum alloys. National Cylinder Gas Co., Chicago. **July, 1942.**

» «

Gloves

Woman's Work Glove, 14640. A flexible, comfortably fitting general purpose work glove especially designed for women. Glove is made of light weight horsehide with an open back and an elastic web band. An extra thickness of leather is provided on the thumb and first two fingers. Industrial Gloves Co., Danville, Ill. **August, 1942.**

» «

Goggles

Face-Fitt. A line of composition-frame goggles available in three sizes. All are drop-eye shape and ventilated at top and bottom with more than 700 holes. Kimball Safety Products Co., Cleveland. **October, 1941.**

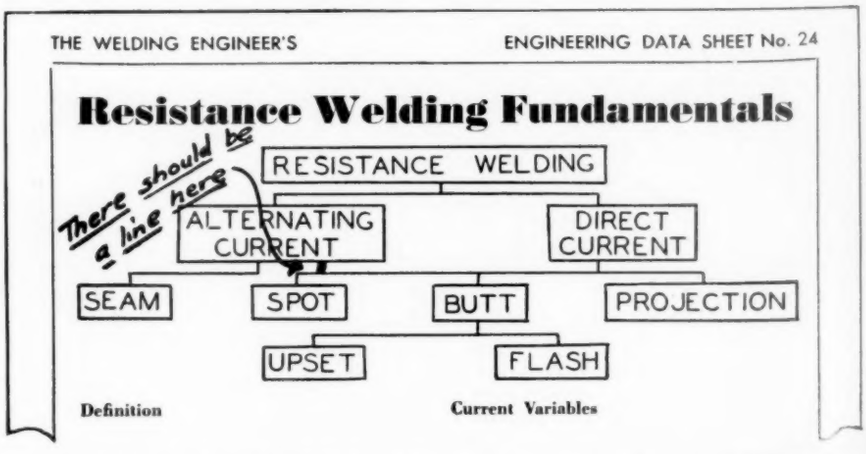
» «

Supervisor Spectacles. A light weight, rimless type spectacle with lenses of Tulca safety material (not glass). Available either with or without side shields. Tulca Div., Univis Lens Co., Dayton, O. **December, 1941.**

» «

Non-Fogging Goggles, 421. Weighing but 3 oz, these goggles are of moulded Durez plastic with shallow eye cups designed for snug fitting. A series of vents is placed all around the back of the lenses; these vents, states manufacture, provide a continuous air intake and exhaust which eliminates

Correct Your Data Sheet



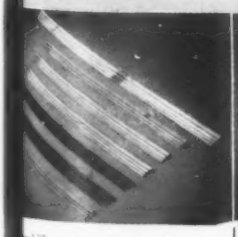
Line indicated by arrow should be added to page 57, September, THE WELDING ENGINEER

WELDING..

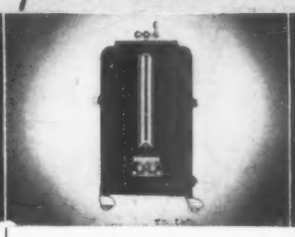
Tanks . . . Guns . . . Planes — and even the Ships used to transport them — are getting to our fighting fronts faster and in greater number because of welding.

Hollup Corporation, a division of National Cylinder Gas Company, is doing all it can in the 24 hours of each day to speed its output of rods and electrodes, A.C. and D.C. welding machines, "Shield-o-matic" welding apparatus, and the new Stud Welding System.

HOLLUP *products and services are helping speed war production*

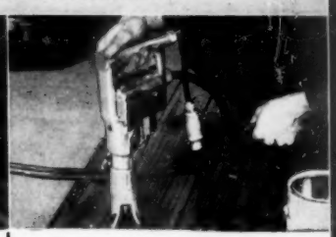


"...protected arc electrodes in many types and sizes, for best results for any job.



Electric welders for A.C. or D.C. operation are available in a complete range of sizes to meet any requirement.

"Shield-o-matic"—fully automatic shielded-arc welding process which meets all code requirements.



Stud welding system for production end-welding of steel sections to metal surfaces.

HOLLUP products may help speed your output . . . *Write for literature, specifying equipment in which you are interested.*

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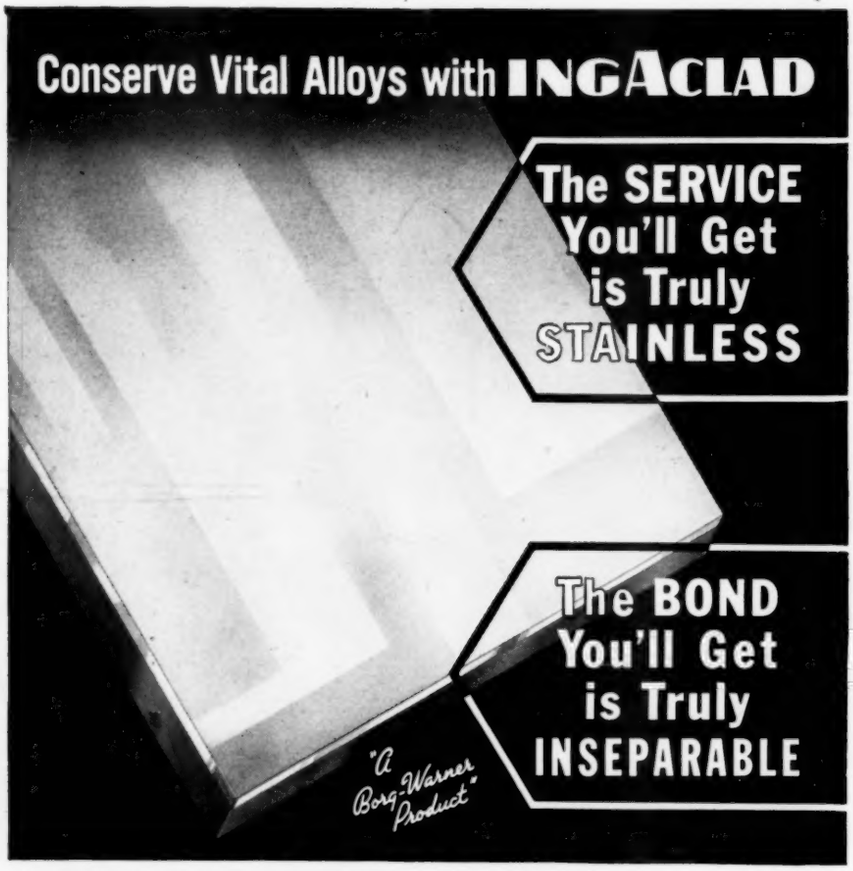
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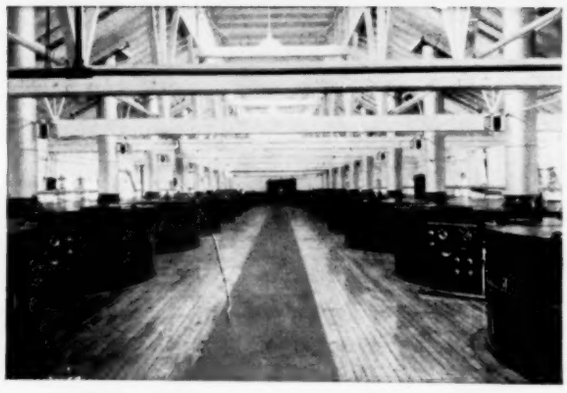
The SERVICE You'll Get is Truly STAINLESS
The BOND You'll Get is Truly INSEPARABLE
"A Borg-Warner Product"



Ten years ago, a leading manufacturer of soaps had this battery of kettles lined with IngAclad. They are in service today, along with many other installations of IngAclad equipment.

10 Years in Actual Use
Prove the Dependability of . . .

INGACLAD
STAINLESS-CLAD STEEL

Today, many manufacturers and fabricators are finding that IngAclad meets every requirement for the stainless service they need, and at much lower cost. They are also finding that if they enjoy a priority rating, they can, in many cases, obtain IngAclad when it would be impossible to secure the solid stainless metal. Installations that have given continuous service for the past 10 years prove you take no chances when you specify or use IngAclad Stainless-Clad Steel.

Write for special IngAclad Folder and Prices.
Fabricators are invited to write for the IngAclad Welding Manual.

INGERSOLL STEEL & DISC DIVISION
BORG-WARNER CORPORATION
310 South Michigan Avenue • Chicago, Illinois
Plants: Chicago, Ill., New Castle, Ind., Kalamazoo, Mich.

practically all chances of lens fogging. Sellstrom Mfg. Co., Chicago. **August, 1942.**

» «

Grinders

Cutting Wheel Dresser. A new abrasive wheel type dresser that is said to give a cutting and truing effect almost equal to that of a diamond. Besides general cleaning and truing of a grinding wheel, other uses include the truing of cut-up and uneven sides and restoring out-of-balance wheels into true rotating ones. Ideal Commutator Dresser Co., Sycamore, Ill. **October, 1941.**

» «

Por-os-way. A precision grinding wheel for hard alloys, copper, aluminum, etc., as well as plastics and other soft materials. The structure of the wheel is "stringy" and porous; the resulting air cells, it is claimed, keep every grinding contact cool. A. P. deSanno & Son, Inc., Phoenixville, Pa. **February, 1942.**

» «

Gun Welders

Progressive. A light weight portable welding gun designed for resistance welding of aluminum. It is air-operated and can produce a maximum pressure of 1,200 psi while using normal airplane factory pressure. Gun has a maximum stroke of 4 in., and all of the operating mechanism is built into the gun head. Progressive Welder Co., Detroit. **January, 1942.**

» «

Compound Hangers. A line of compound, springless hangers suitable for welding guns. Counterbalanced arms make the guns "stay put," yet keep them within easy reach of the operator. Hangers are available in two sizes: No. 87DS9 for light and medium duty, No. 87DS10 for heavy duty. Progressive Welder Co., Detroit. **January, 1942.**

» «

Sciaky, P-1-R. A radial-type gun spot welder available in both stationary and buggy-mounted units. It is equipped with a Sciaky welding timer and operates on single phase A-C, 220 or 440 volts. A hydro-pneumatic booster makes possible a maximum electrode pressure of 1,800 lb with 90 psi of air supply. Sciaky Brothers, Chicago. **September, 1942.**

» «

Hard-Facing Materials

V-Mang. A manganese steel welding electrode of alloy steel containing 12 to 14% manganese, molybdenum and other elements. Besides build-up work, it can also be used to repair fractures in manganese steel parts. Available bare and coated in diam of 1/8, 5/32, 3/16 and 1/4 in. American Manganese Steel Div., American Brake Shoe & Foundry Co., Chicago Heights, Ill. **April, 1942.**

Don't Let Eye Fatigue Wreck Work Schedules

Provide your Welders with AO Helmets Equipped with

Filterweld Plates

Keep your workers *on the job* by providing them with easy-to-wear AO helmets—equipped with AO Filterweld, a service-proved welding plate, developed by American Optical Company Research Laboratories.

Filterweld* is obtainable without delay in shade Nos. 8, 9, 10, 11, 12 and 13. It is scientifically controlled in production with fixed standards of densities and conforms with U. S. Bureau of Standards Handbook H24.

Get in touch with your nearest AO Branch Office for American Welding Helmets, Hand Shields and Filterweld Plates.

*T. M.—Reg. U. S. Pat. Off.

American Optical

COMPANY

SOUTHBRIDGE, MASSACHUSETTS

Stoodite K, Stoody Self-Hardening K. These are alloy rods which contain no chromium, but they are said to be comparable to regular Stoody alloys with regard to ease of application and resistance to wear. Stoody Co., Whittier, Calif. **April, 1942.**

» «

High-Frequency Converters

Cold-Arc. A unit said to be suitable for attachment to any 60-cycle A-C welder, which produces high frequency. A-C Devices Co., Chicago. **October, 1941.**

» «

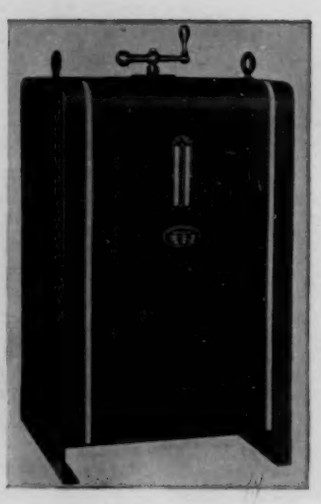
Missing Link. A high frequency attachment for arc welders said to produce over a million impulses per sec. Advantages claimed by manufacturer are automatic starting of arc without electrode touching work, better avoidance of excessive currents for thin or easily burned materials, satisfactory use of 1/8 and 1/4 in. electrodes. May be attached to either A-C or D-C welders but is used primarily with A-C. Two models: No. 1 for use on welders with capacity up to 300 amp, No. 2 with capacity up to 600 amp. Mid-States Equipment Co., Chicago. **August, 1942.**

» «

Miller Expands! Miller Delivers!

TAKE YOUR CHOICE!

SIX INDUSTRIAL MODELS, 300 TO 1,000 AMPERES



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PHONE 4190 RICHMOND, INDIANA NOW!

More and more calls for Miller A.C. Welders have resulted in our increasing our production facilities. As this publication goes to press, we are in a position to give remarkable delivery on your quantity requirements.

Miller Industrial A.C. Welders are assisting in every branch of the War Effort — Tanks, Ships, Planes — all such plants are Miller Equipped.

These War Production times mean welder orders in lots of hundreds. Our increased facilities may be overtaken by an avalanche of orders any day. Play Safe! Phone Today!

MILLER ELECTRIC MFG. CO., INC.

Factory—Appleton, Wisconsin Sales—Richmond, Indiana

Hoisting Trucks

A line of storage battery powered vehicles which will lift from 2,000 to 7,000 lb, using a hydraulic vane-type pump driven by a series wound motor. Load may be tilted backward for safe riding and tilted forward for tiering. Clark Tructractor Div., Clark Equipment Co., Battle Creek. **July, 1942.**

» «

Hydraulic Vises

Studebaker. A hydraulic vise operated entirely by foot control. One pedal moves the vise jaw to contact against the work, second pedal applies pressure up to five tons and a third pedal releases jaw. Studebaker Machine Co., Chicago. **October, 1941.**

» «

Drilvise. Intended primarily for drill work, this hydraulicly operated vise is suitable for many other kinds of jobs as well. It is controlled by three foot pedals: one for gripping, one for applying pressure up to the maximum of 10,000 psi, and one for releasing work. Studebaker Machine Co., Chicago. **September, 1942.**

» «

Identification Unit

Wim. A photographic device for industrial plants or other places where employee identification is necessary. It is said to be capable of taking a thousand pictures a day. Photographic Equipment, Inc., Pittsburgh. **June, 1942.**

» «

Insulating Varnish

S-10. An insulating varnish for application to electrical apparatus that must operate at abnormally high temperatures. Sterling Varnish Co., Haysville, Pa. **May, 1942.**

» «

Insulation Tester

Model 520. An insulation and breakdown tester featuring a super-sensitive danger indicator which lights up to indicate leakage up to 1,000 megohms. Superior Instruments Co., New York City. **June, 1942.**

» «

Lens Protector

Dolph's No. 253 Glascote Clear. This material, originally developed for use on electric bulbs and porthole lights, is now used on welding helmets and goggle lenses to prevent breakage or pitting of the surface by welding spatter. Material is transparent and will not darken under heat, it is stated. John C. Dolph Co., Newark, N. J. **October, 1941.**

» «

Limit Switches

Class 9007, Type P. A line of small, precision limit switches for use where space and operating force are limited. Basic switch units are only 2 in. long by 1 in. square. Industrial Controller

Helpful Information on the Use of HAYNES STELLITE HARD-FACING MATERIALS

MATERIAL	PHYSICAL PROPERTIES	PURPOSES FOR WHICH USED	TECHNIQUE POINTERS FOR APPLICATION	METALS THAT CAN BE SURFACED
HAYNES STELLITE ALLOY No. 1	–red hardness –high abrasion resistance –low coefficient of friction –good corrosion resistance –tensile strength—47,000 lb. per sq. in. –hardness—Rockwell C-54 –coefficient of expansion—similar to steel –hardest of the three grades and most resistant to abrasion.	–For coating surfaces subjected to severe abrasive wear and only slight shock or impact.	***For Steel*** –Remove all rust or scale from surface. –Preheat part to be coated if necessary. –Adjust flame so there is an excess of acetylene. The excess acetylene "feather" should be twice as long as the inner cone. –Bring small surface of base metal to a "sweating" condition, insert end of rod into flame and let rod melt and spread over "sweating" area. –Continue applying until entire surface to be faced is built up to required depth. Do not puddle. ***For Cast Iron*** –Similar to steel except use slightly less excess of acetylene. It is necessary to break up the surface "crust" with end of rod. "Ferro" flux facilitates this operation and is recommended if base metal is dirty.	***Carbon Steels*** up to 0.60 per cent carbon ***High-Carbon Steels*** above 0.60 per cent carbon if properly heat-treated before and after ***Low-Alloy Steels*** heat-treatment may be necessary ***High-Speed Steel*** not recommended ***Manganese Steel*** use electric welding only ***Stainless Steels*** heat-treatment is necessary ***Cast Iron*** easily hard-faced ***Chilled Iron*** on small parts only ***Alloy Cast Iron*** same technique as for gray cast iron ***Monel Metal*** easily hard-faced ***Brass and Bronze*** not recommended ***Copper*** not easy to do ***Aluminum*** cannot be hard-faced ***Hascrome Rod Deposit*** easily faced ***Nitrided Steel*** grind off case before hard-facing
HAYNES STELLITE ALLOY No. 6	–red hardness –high abrasion resistance –low coefficient of friction –good corrosion resistance –tensile strength—105,000 lb. per sq. in. –hardness—Rockwell C-40 –coefficient of expansion—similar to steel –not as hard as, but tougher than, No. 1 or No. 12. Resistance to abrasion slightly less than No. 12. Does not check easily.	–For coating surfaces subjected to abrasive wear accompanied by considerable impact. Also recommended for cutting edges of hot-work dies. Also for valves of all kinds.		
HAYNES STELLITE ALLOY No. 12	–red hardness –high abrasion resistance –low coefficient of friction –good corrosion resistance –tensile strength—76,000 lb. per sq. in. –hardness—Rockwell C-48 –coefficient of expansion—similar to steel –not quite as hard as No. 1 and slightly less abrasion resistant. Stronger and more ductile; more resistant to impact.	–For coating surfaces subjected to severe wear with enough impact to require more toughness than is possessed by No. 1.		
HAYNES STELLITE "93" ALLOY	–high cold hardness –high abrasion resistance –moderate impact resistance –tensile strength—43,040 lb. per sq. in. –hardness—Rockwell C-62 –coefficient of expansion—similar to steel	–For applications where high cold hardness is necessary and corrosion is not an important factor.	–Use flame half way between that for Hascrome rod and that for Haynes Stellite rod. –Applied like Haynes Stellite rod except that mild puddling is permissible on dirty surfaces or for obtaining an extra smooth surface.	
HASCROME ROD	–self-hardening –work-hardening –good abrasion resistance –high impact resistance –tensile strength—40,000 lb. per sq. in. –hardness—Brinell 240 to 500 as deposited depending on application technique. –tougher than Haynes Stellite alloys but not as resistant to abrasion.	–For surfaces subjected to abrasive wear and severe impact. –Makes a very good base for subsequent coating of Haynes Stellite alloys because it resists the mushrooming effect of impact.	–A flame adjustment half way between neutral and that for Haynes Stellite rod is best. –Base metal should be at a "sweating" heat. –Do not puddle. –Use "Ferro" flux if base metal is dirty.	***Manganese Steel*** use electric welding only ***Carbon Steels*** easily applied ***Low Alloy Steels*** heat-treatment may be necessary both before and after ***Alloy Castings*** consider heat-treatment ***Gray Cast Iron*** easily applied
HAYSTELLITE TUBE ROD	–various screen sizes of sharp, irregularly shaped grains contained in tubes of High Test Steel –easily applied by welding flame.	–Where utmost resistance to abrasion is necessary, such as for coating oil well drilling tools.	–Applied in manner similar to other hard-facing rods avoiding deep puddling but obtaining enough penetration to make strongest bond between base metal and binding material.	Same as Haynes Stellite alloys

Send for the free wall chart, "Hard-Facing Materials Data." It includes the above information and other helpful data.

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

New York, N. Y. UCC Kokomo, Indiana

Chicago—Cleveland—Detroit—Houston—Los Angeles—San Francisco—Tulsa

RED-HARD, WEAR-RESISTING ALLOY OF COBALT, CHROMIUM, AND TUNGSTEN.

The words "Haynes Stellite," "Hascrome," and "Haystellite" are registered trademarks of Haynes Stellite Company.

Easier to handle **because of special features found in no other cleaning tools, and** *longer-lasting* **— CMD Chipping Hammers are speeding up removal of slag, spatter, and welds in hundreds of shipyards and war plants. First choice of experienced welders for 17 years, CMD hammers are more popular than ever now.**

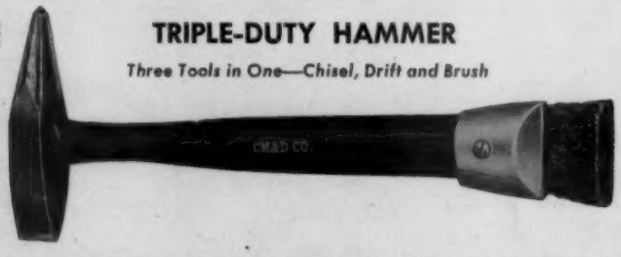
CHIPPING HAMMERS

First Choice of Welders for 17 Years!

TYPE CB

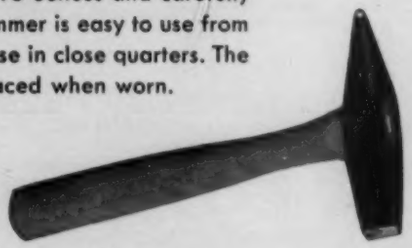
TRIPLE-DUTY HAMMER

Three Tools in One—Chisel, Drift and Brush



This time-saver has many practical features. Without setting down the welding rod holder, the welder can chip or brush away the slag and spatter. Weighing only 16 ounces and carefully balanced, this CMD Hammer is easy to use from any position. Ideal for use in close quarters. The wire brush can be replaced when worn.

TYPE C



COMBINATION DRIFT AND CHISEL

This hammer is similar to Type CB, but does not have the wire brush. The heads of both hammers are made of high-grade tool steel, heat-treated to withstand severe service.

ORDER FROM YOUR JOBBER!

If he cannot supply you, write directly to us.

CHICAGO MANUFACTURING AND DISTRIBUTING COMPANY

Dept. W., 1928 West 46th St., Chicago, Illinois

Div., Square D Co., Milwaukee. **June, 1942.**

» «

Lighting Fixtures

FPS-40 Fluorescent Luminaire. A unit which uses two or three 40-watt fluorescent lamps per reflector, providing lighting intensities of from 30 to 100 ft-c. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. **January, 1942.**

» «

Elipso Standlite. An elliptically shaped reflector designed for protective illumination around industrial plants. Using 300 to 500 watt lamps, it provides a wide lateral distribution of light with a low mounting height. Goodrich Electric Co., Chicago. **February, 1942.**

» «

Low Temperature Alloy

Coldweld. An alloy for the low temperature welding of cast iron castings. Eutectic Welding Alloys, Inc., New York City. **October, 1941.**

» «

Lubricant

Crystal Solid Oil. A water-repellant lubricant especially designed for use on the spindle bearings of seam welders, which bearings are frequently called upon to carry current while turning in water. Stevens Grease and Oil Co., Cleveland. **January, 1942.**

» «

Metal Coating Compound

AMCO Metallic Coating Powder, Brand K. This product is designed for making repairs to damaged tin coatings. The new coating will protect the underlying iron or steel to the same extent as a hot-dipped zinc coating of the same thickness, claims manufacturer. American Solder & Flux Co., Philadelphia. **November, 1941.**

» «

Noise Eliminator

M. A. S. Ear Defender. A device for reducing the detrimental effect of noise upon workers. The molded soft rubber ear plugs, it is claimed, will reduce loud noises by 35 to 40 decibels, or to about 1/10th their former loudness. Mine Safety Appliances Co., Pittsburgh. **November, 1941.**

» «

Perspiration Retainer

A light weight absorbent sweatband made of synthetic sponge. It keeps sweat out of eyes and off goggles, thereby keeping weldor's vision clear. Sponge can be sterilized and used again and again. American Optical Co., Southbridge, Mass. **October, 1941.**

» «

Projection Welder

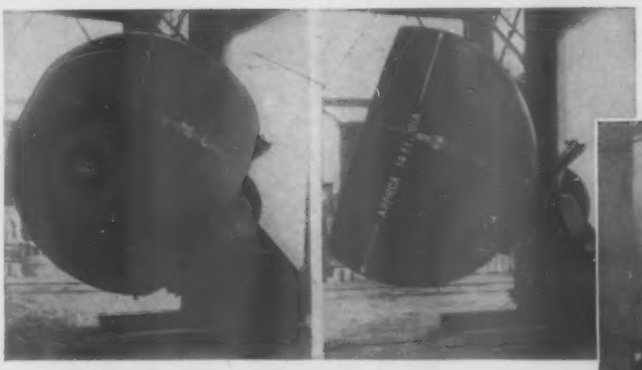
Eisler, 600 KKD. An air-operated projection spot welding machine, with

Ransome Welding Positioners for Greater Production

Left. Many-angled piece positioned for all down-hand welds.

Center. Heavy machine bases are of welded construction.

Right. A complicated weldment easily handled on a positioner.



Standard positioner fitted with extension brackets for handling work larger than the table top, such as tanks, frames, etc.

Rotating Welding Fixtures consisting of motor-operated Head-stock with Tail-stock unit, handling large frame. Tail-stock is placed to accommodate objects of various lengths.

BOOTH B-102 • NATIONAL METAL SHOW • CLEVELAND • OCTOBER 12th thru 16th

Light-duty Hand-operated | 2500 lb. Cap. on Elevating Base | 3000 lb. Cap. | 3 Ton Cap. | 8 Ton Cap. | 20 Ton Cap.

INDUSTRIAL DIVISION **RANSOME MACHINERY CO.** DUNELLEN NEW JERSEY

AGILE WELDING ELECTRODES

RED-WHITE

Used mainly in this nation's vast shipbuilding program.

BLUE-RED

Another excellent shipbuilding electrode. Also used in great quantities in Defense Training Schools.

BLUE-GREY

An electrode designed primarily for fillet welding. This semi-automatic electrode can be used for the making of professional fillet welds in the hands of an inexperienced welder with only an hours training.

DARK-GREEN

A hard surfacing electrode recommended for the repair of worn machinery parts, plows, shovel teeth, valves, dies and tools, etc. 45-60 Rockwell C.

PINK

This electrode and Agile Dark Green will solve 90% of your hard surfacing problems.

YELLOW

Used for the welding of cast iron. A great factor in the salvaging of broken machinery parts. Gives a machineable weld. The object to be welded needs no preheating.

AGILE ACTARC

WHEN JOHNNY COMES MARCHING HOME

Victory is the happy ending to this War. On all production fronts Agile Welding Electrodes are doing a mighty job and doing it well. They are helping forge the weapons necessary to bring ultimate and final victory to Wartime America.

In the peacetime that is to come, Agile Welding Electrodes will help forge the items necessary to maintain the high living standards of Peacetime America.

Buy War Savings Bonds and Stamps

AMERICAN AGILE *Corporation*

5806 HOUGH AVE. CLEVELAND, O.

special jigs and fixtures, for welding fins to steel tubing. There are 56 points of heat control. Eisler Engineering Co., Inc., Newark, N. J. **November, 1941.**

» «

Refrigerated Welding

Frostrode. A line of five self-contained refrigerating units for spot welders. These units are intended primarily for those welding jobs where water-cooling has proved inadequate. Sizes range from a small unit for a light steel spot welder to a large unit for use with either a heavy steel welder or a bank of eight aluminum welders. Weltronic Corp., Detroit. **March, 1942.**

» «

Regulator

Victor. A two-stage regulator unit for oxy-acetylene welding, claimed capable of delivering, with maximum pressure accuracy, over 100,000 cu ft per hr of oxygen. It includes a spring-loaded diaphragm regulator which reduces primary cylinder pressure from 2,000 to 250 psi and a pilot regulator which enables operator to adjust final operating and delivery pressure. Victor Equipment Co., San Francisco. **December, 1941.**

» «

Resistance Welding Controls

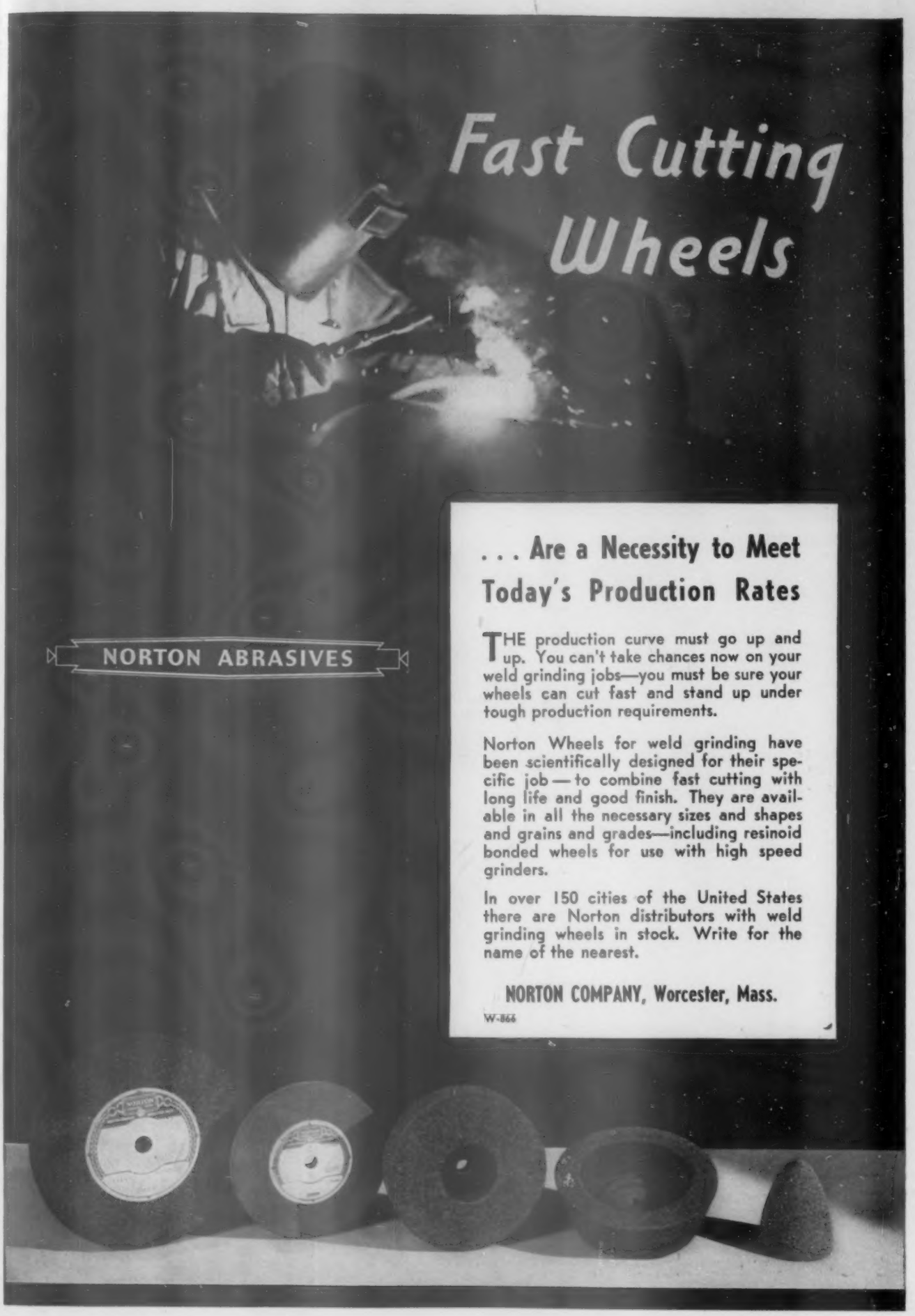
Weltronic. Complete power and control units in one cabinet, including contactors and firing relays, sequence timer, protecting fuses, limit switches, motor starter, low voltage transformer and relay, etc. Simple three-wire connections are made to a 440 or 220 volt power supply circuit, and only simple wiring is required to connect the complete set of controls to the machine. These units are available with a wide variety of contactors, ranging up to 600 amp capacity, and with synchronous and non-synchronous types of timers. Weltronic Corp., Detroit. **November, 1941.**

» «

Automatic Timer. A precision timer for automatically controlling the welding time period of Ace spot welders. Timer is of the electronic tube type, and maximum timing variation is controlled to a plus or minus 1/120 sec. Pier Equipment Mfg. Co., Benton Harbor, Mich. **November, 1941.**

» «

G-E Capacitor Discharge Control. A unit specially designed for use with stored-energy resistance welding machines. The control cabinet contains up to 22 capacitors, any number of which can be used at one time. Two special tap switches select the number of capacitors desired in one-unit steps, each of 120 microfarads. A special circuit prevents operation of the welding machine if the capacitor voltage is more than 3% below its preselected value, reducing the possibility of insufficient energy to produce good


Fast Cutting Wheels
NORTON ABRASIVES
. . . Are a Necessity to Meet Today's Production Rates
THE production curve must go up and up. You can't take chances now on your weld grinding jobs—you must be sure your wheels can cut fast and stand up under tough production requirements.
Norton Wheels for weld grinding have been scientifically designed for their specific job — to combine fast cutting with long life and good finish. They are available in all the necessary sizes and shapes and grains and grades—including resinoid bonded wheels for use with high speed grinders.
In over 150 cities of the United States there are Norton distributors with weld grinding wheels in stock. Write for the name of the nearest.
NORTON COMPANY, Worcester, Mass.
W-866

Dipper Teeth Reclaimed at One-Fourth Cost of New Teeth

"And They're Better Than New Ones"

Reports the Big Rock Stone Company

One good thing that will come out of this war is the realization, on the part of many heavy equipment users not already convinced, that a worn part is not ready for discard if it can be restored by reclamation welding.

The Big Rock Stone Co. of Little Rock, Ark., didn't wait for the war to avail themselves of the advantages of reclamation welding and their foresighted policy can be adopted with profit by many operators.

As an example of their salvage work, a power shovel dipper tooth as worn and as restored by welding are shown, (A300) held by Frank Stockett, master welder of this firm. An Amsco cast dipper tooth repointer bar torch-cut to the correct width was welded on with V-Mang — Amsco's new moly-manganese steel rod, in progressive steps as shown.

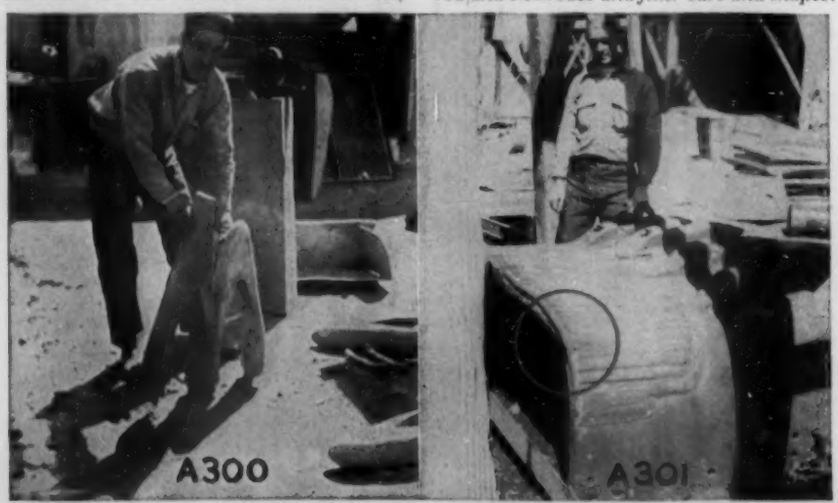
After localized heating with the torch (never over 300° F. on 13% manganese steel), the repointer was welded on ⅛" to ¼" off center line of tooth. A space equal to the diameter of the rod was left between repointer and tooth to provide penetration of first beads. The bead was carried across the full width of the tooth, held to 1" wide and peened vigorously. Then the tooth was turned and the other side started the same way. Several beads were applied and peened on each side alternately until tooth and repointer were flush.

Mr. Tracy, general superintendent, reported that their worn dipper teeth are reclaimed in this manner at about one-fourth the cost of new teeth and that they get even greater service as a result of the work-hardening peening that is done during the welding operation. The high alloy content of V-Mang no doubt contributes to the added service life.

The dipper front shown (A301) was actually worn through at one spot when it was reclaimed with Amsco round manganese steel filler bars tacked-on and filled in with V-Mang. The original weight of this 13% manganese steel front was approximately 5,500 lbs. and about 550 lbs. of welding material was applied, thus saving approximately 4,950 lbs. of casting metal for other war production.

These are only two of the many uses Amsco build-up and hard-facing welding products are put to in the quarry and crushing plant of this firm. In each instance, the savings have made reclamation worthwhile and this company is at the same time doing their part in conserving vital war materials.

Send for Bulletin 941-W on Amsco Welding Products. Ask, too, for printed instruction sheets on how to apply Amsco welding rod and electrodes and filler bars and shapes.



Amsco

AMERICAN MANGANESE STEEL DIVISION
OF THE AMERICAN BRAKE SHOE & FOUNDRY CO.
Chicago Heights, Illinois

Manganese Steel Castings for shocks and abrasion.
Chromium-Nickel Alloy Castings for heat and corrosion resistance.
Power Shovel Dippers. Dredge and Industrial Pumps.
Welding Materials for reclamation and hard-surfacing.

FOUNDRIES AT CHICAGO HEIGHTS, ILL.; NEW CASTLE, DEL.; DENVER, COLO.; OAKLAND, CALIF.; LOS ANGELES, CALIF.; ST. LOUIS, MO. OFFICES IN PRINCIPAL CITIES

welds. General Electric Co., Schenectady, N. Y. **November, 1941.**

» «

Westinghouse Sequence Timer. A weld and sequence timer housed in a steel wall-mounted enclosure. The timing circuit is fully electronic and consists essentially of a resistor capacitor circuit with charging rate adjustable by varying a resistor. The voltage of the circuit is applied to the grid of a thyratron tube, which becomes energized and operates the relay after a predetermined charging time has elapsed. Westinghouse Electric & Mfg. Co., East Pittsburgh. **March, 1942.**

» «

National Duo-Trol Weld Timer. A combination weld timer and heat control for resistance welding where production processes require frequent changes of weld time setting and positive control over transformer heat. Weld time may be varied in 24 half-cycle steps from ½ cycle up. One division on heat control dial changes heat about 2%. National Time & Signal Corp., Detroit. **March, 1942.**

» «

Safront. These controls are manufactured in the 18 NEMA standard types of weld and sequence timers and will fill practically any welder requirements. Timing periods from 3 to 100 cycles are provided by means of a magnetic timing device. Industrial Control Div., Square D Co., Milwaukee. **April, 1942.**

» «

Weltronic, Model 40. A full-electronic timer and control designed for use with seam welders as well as spot welders. Of the synchronous type and incorporating phase-shift type heat control, the Weltronic 40 always starts and stops current flow at the zero point of the current wave. Current duration is adjustable to the exact number of cycles desired. Both single shot and pulsation type welding controls are provided. Weltronic Corp., Detroit. **June, 1942.**

» «

Tandem Timer. Essentially a control unit with two individual and variable plug-in type timing elements. When these are adjusted to the desired time intervals, each cycle of operation will follow the other continuously in regular sequence. No further adjustments are necessary until a new sequence is required. Six standard models are available, offering settings ranging from ¼ sec to 2 hr 45 min. Industrial Timer Corp., Newark. **August, 1942.**

» «

Respirators

M.S.A. Single Filter Dustfoe. An improved model which retains the advantages of this make of respirator but replaces the former two-part filter with a single one-piece filter. Mine Safety

THERE'S NO SECRET

ABOUT THIS WEAPON*

FOR ALL-OUT WAR PRODUCTION

Thousands of production men all over the country know how the superb performance of MARQUETTE A.C. ARC WELDERS helps them lick today's tough production problems and to meet otherwise impossible deadlines.

Marquette's entire facilities are geared to expedite this increased production with prompt shipment on priority rated orders.

Send for free, 24 page, illustrated booklet.

MARQUETTE MFG. CO., INC. **Minneapolis, Minn.**

MARQUETTE *Gives You*

LOW INITIAL COST and negligible maintenance cost, no moving parts to wear out.

LOW OPERATION COST . . . high power factor and extremely low idling cost.

SIMPLE, FAST OPERATION. A tap for every heat . . . a heat for every job. Just plug in and weld.

AUTOMATIC VOLTAGE CONTROL for superb arc performance at all heat stages. No troublesome "magnetic blow" or "snuff-outs" to harass the operator and spoil welds.

ALL-ASBESTOS INSULATION and EXTRA STURDY CONSTRUCTION for hard, 'round the clock, usage.

COMPLETE EQUIPMENT. Nothing more to buy.

FIVE SUPERB MODELS. 150 to 400 amperes, for light work to heavy duty industrial production. All models listed and approved by Underwriters' Laboratories, Inc.

***SEE THEM IN BOOTH A-315**
NATIONAL METAL EXPOSITION
Public Auditorium—Cleveland, Ohio
October 12 - 16, 1942

MARQUETTE
REG. U. S. PAT. OFF.
A.C. ARC WELDERS

Appliances Co., Pittsburgh. **November, 1941.**

» «

American R9100-T. An easily adjusted face piece with leak-sealing rubber edges features the design of this respirator. Approved by the U. S. Bureau of Mines for protection against the inhalation of toxic or poisonous dusts such as lead, cadmium, arsenic, chromium, manganese, selenium, vanadium and compounds. American Optical Co., Southbridge, Mass. **May, 1942.**

» «

Rheostat Cages

A variety of ventilated, dust-proof and other types of cages for use with Ohmite rheostats. Ohmite Mfg. Co., Chicago. **February, 1942.**

» «

Safety Clothing

Esco. A complete line of weldors' chrome leather protective clothing, including full coats, pants, overalls, rod holders, sleeves, cape with bib attached, cape with detachable bib, spats, aprons and chaps. Eastern Safety Clothing Co., New York City. **January, 1942.**

» «

M.S.A. Asbestos Suit. A one-piece asbestos suit consisting of an upper-and-lower gament securely sewed together, with helmet, gloves and boots attached. This unit, states manufacturer, serves a threefold purpose: it prevents the entry of flame, insulates against heat, and guards the head from injury by falling or flying material. Mine Safety Appliances Co., Pittsburgh. **April, 1942.**

» «

Neoprene Coated Clothing. This line includes many articles used by weldors —welding jackets, aprons, sleeves, coveralls, leggings and gloves. Most items are available in either light or heavy weight material. This clothing is said to provide protection against heat, sparks, splash, acids, chemicals and oils. Safety Clothing & Equipment Co., Cleveland. **May, 1942.**

» «

Seam Welders

Progressive. A complete line of seam welders in three capacity ranges and 126 models. In each of the light, medium and heavy-duty series, several standard throat depths are available. Each type is also available in six different standard drives: three for circular and three for straight seam welding. Progressive Welder Co., Detroit. **June, 1942.**

» «

Spatter Preventatives

Acme Quality Industrial Finish Flash-Off No. 99. Designed to eliminate weld spatters and the cost of removing them, this product is brushed, sprayed or simply wiped along the edges of the metal surfaces to be joined. Available in 55-gal drums and 5-gal cans. Acme White Lead and Color Works, Detroit. **May, 1942.**

» «

Protect-O-Metal No. 2. This compound is brushed down the seam and on the surrounding surfaces. It may be used on either single or multi-pass welds, any amperage, and is said to have a stabilizing and quieting effect on the arc. To remove compound after welding, it is only necessary to wipe surface with a damp cloth, states manufacturer. G. W. Smith & Sons, Dayton, O. **July, 1942.**

» «

Weldmask. This is a creamy white protective liquid, applied with a brush to about 3 in. on both sides of the joint. Welding is done through the coating, which has no effect on the fusion of metals. Residue and molten particles are removed with a hand and wirebrush after welding. Turco Products, Inc., Los Angeles. **July, 1942.**

» «

Spot Welders

Progressive. A line of rocker-arm spot welding machines for either foot, compressed air or motor operation. There are 48 models with four capacities—20, 30, 40 and 50 kva—and throat depths ranging from 12 to 36 in. All models are equipped with an eight-

Grind Quicker...
Grind Smoother
ON EVERY WAR-TIME JOB
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EVERY MAN COUNTS FOR MORE
USING SKILSAW TOOLS!
NEW!
SKILSAW PORTABLE GRINDERS
Just introduced to speed up production on every war-time job...grinding down rough welds, smoothing welding beads, cleaning metals, filing, buffing and polishing on every metal surface. Two Models.
• Here are FIVE kinds of SKILSAW TOOLS you shouldn't be without, if you want to speed your finishing operations, reduce waste and increase your output in war production. Do you have welds to grind down? Stainless steel or brass sheets to polish? Castings to clean? Small machine parts to finish? There's a SKILSAW TOOL for each of these operations . . . and the job will get done quicker and better and at lower cost.
These SKILSAW GRINDERS and SANDERS are typical of the entire line of SKILSAW TOOLS—designed to deliver results under today's stepped-up conditions, built to stand hard usage without time-wasting breakdowns. Look into America's busiest war-work plants and you'll see SKILSAW TOOLS on the job. Ask your distributor for a demonstration and you'll see why!
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Sanding stainless steel to a perfect finish is faster with SKILSAW Disc Sanders. Also remove waste metal, buff and polish on all surfaces.
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Spotted conveniently throughout the plant, SKILSAW Bench Grinders speed production, keep tools and twist drills sharp, grind small parts.
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stage heat regulator, adjustable from the rear of the machine. Timers and contactors, both mechanical and full-electronic, are available at extra cost. Progressive Welder Co., Detroit. **August, 1942.**

» «

Spot Welding Electrode

Progressive. A line of special electrodes to facilitate the difficult task of spot welding aluminum. Electrodes are fitted with tips of an alloy said to have several times the resistance of conventional electrode materials to "mushrooming" and pick-up. Progressive Welder Co., Detroit. **November, 1941.**

» «

Terminal Panel

O.Z. A welding terminal panel developed particularly for use in shipyards and similar installations in connection with the constant potential system of welding feeders. O.Z. Electrical Mfg. Co., Brooklyn. **December, 1941.**

» «

Tensile Testing Machines

Dillon. A line of low capacity tensile testing machines with capacities ranging from 0-to-50 to 0-to-1,000 lb. They may be obtained in a straight compression type, an expansion type, or a combination. W. C. Dillon & Co., Chicago. **February, 1942.**

» «

Tool Post Attachment

Stow. An attachment, driven by a portable flexible shaft machine, for adapting lathes to different grinding operations, both external and internal. Device accommodates grinding wheels as large as 6 in. diam by 1 in. face; it will operate at speeds as high as 6,800 rpm. Stow Mfg. Co., Binghamton, N. Y. **October, 1941.**

» «

Tool Stands

Lyon. Providing individual tool storage for workers, these stands may also be used as parts, tool and equipment carriers. They are made with one, two or three lockable drawers. Lyon Metal Products, Inc., Aurora, Ill. **July, 1942.**

» «

Torches

Type MM Welding Torch. A light weight torch for aircraft welding, designed to give best results on thicknesses of 1/8 in. and less and up to 1/2 in. It is said to be particularly useful with stainless steel and similar alloys requiring exact heat control. Alexander Milburn Co., Baltimore. **January, 1942.**

» «

Weldit. A light weight torch for aircraft welding and light sheet metal. It weighs less than 3/4 lb, is about 13 in. long, and has a replaceable tip. Weldit Acetylene Co., Detroit. **March, 1942.**

» «

Torch Holder

Airco Protractor Type. A holder designed for use with Radiograph cutting torches. It has a protractor which permits precise angular adjustments within a 90 deg range. Air Reduction Sales Co., New York City. **October, 1941.**

» «

Tube Tester

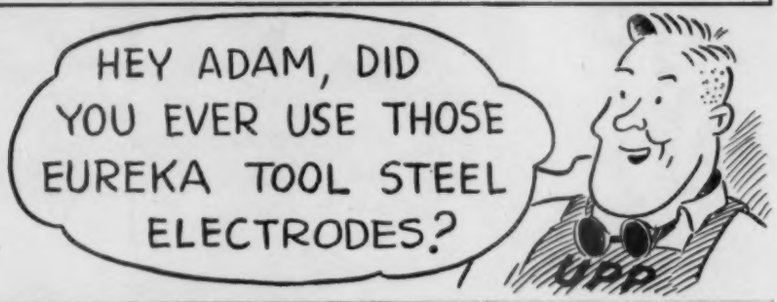
Weltronic. A universal tube checker for industrial-type electronic tubes, provided with seven sockets. This checker permits a visual analysis of plate current through a 1 in. cathode ray tube; high-vacuum tubes can also be checked with the milliammeter provided. Weltronic Corp., Detroit. **December, 1941.**

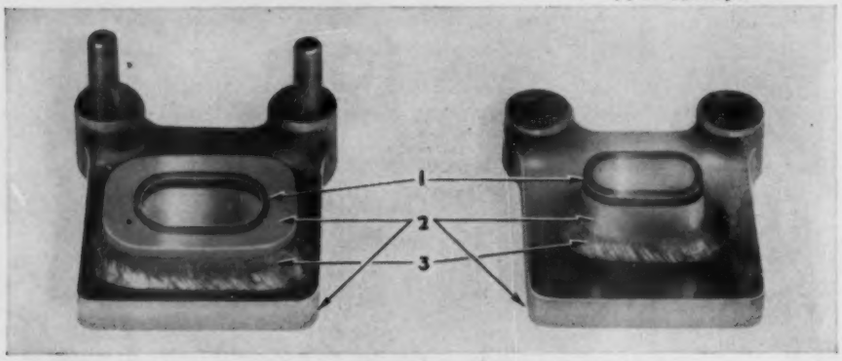
» «

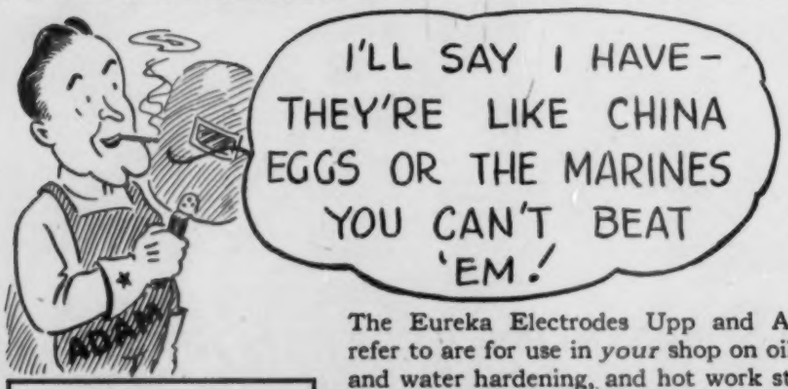
Ventilators

Torit Fume Exhauster 110. These units are designed especially for removal of welding and metallic fumes and are available for either 110 or 220 v, 60 cycle, single phase or 220-440 v, 60 cycle three phase. A unit with 4 in. outlets will carry away 675 cfm of air. Outfit includes a 1 hp motor and a fume hood connected to flexible rubber tub-

UPP and ADAM *Broadcast No. 1002* •• *by* Mason-Hahn







The Eureka Electrodes Upp and Adam refer to are for use in *your* shop on oil, air and water hardening, and hot work steels. We also furnish alloy rods for drawing and forging dies, etc. For further information about Eureka Electrodes please wire or write for our catalog describing in detail the work that can be performed with this type of electrode.

Don't forget our "Suttonizing" Process by which we reclaim by welding all high speed steel tools such as Reamers, Broaches, Taps, Form Cutters, Drills, Hobs, Lathe Centers, Turning Tools, End Mills, etc.

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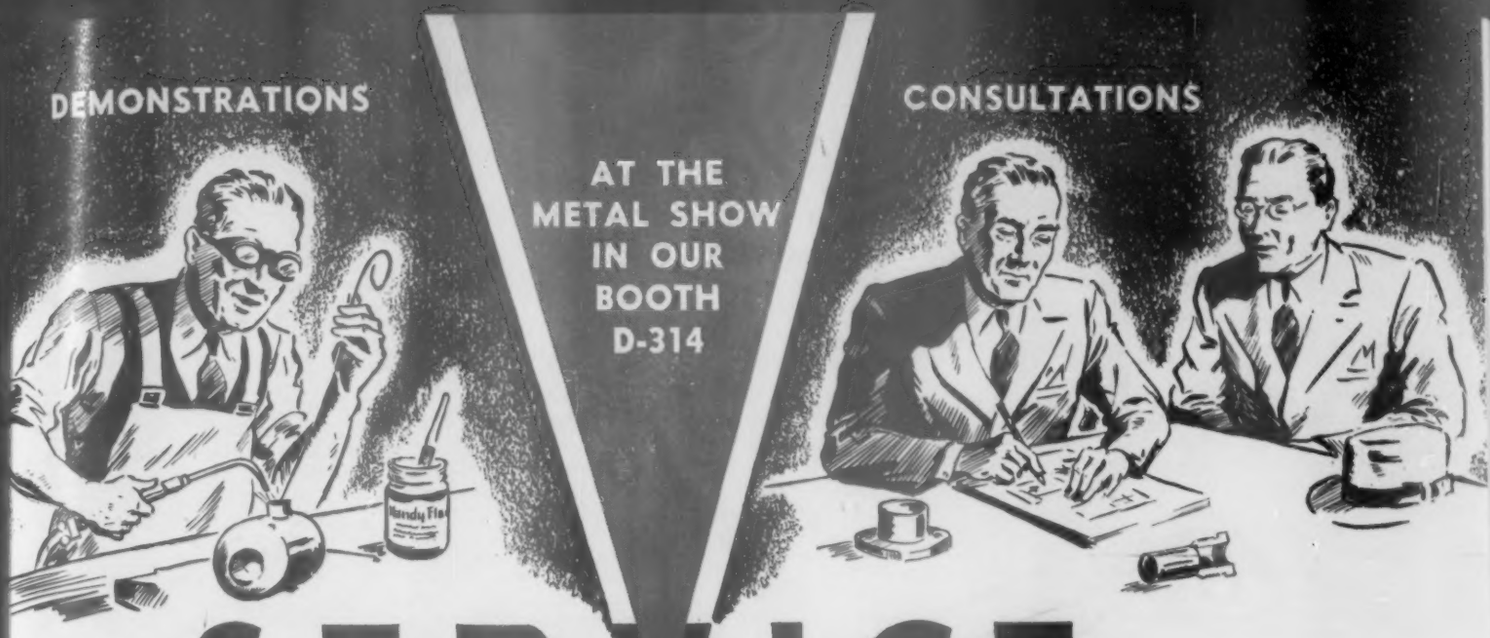
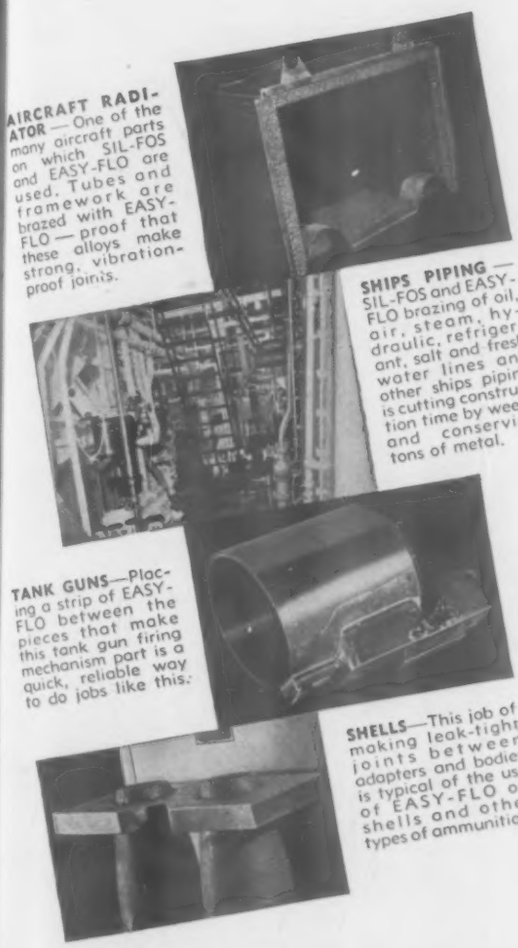


SERVICE

to speed Victory is now the keynote



AIRCRAFT RADIATOR — One of the many aircraft parts on which SIL-FOS and EASY-FLO are used. Tubes and framework are brazed with EASY-FLO — proof that these alloys make strong, vibration-proof joints.

SHIPS PIPING — SIL-FOS and EASY-FLO brazing of oil, air, steam, hydraulic, refrigerant, salt and fresh water lines and other ships piping is cutting construction time by weeks and conserving tons of metal.

TANK GUNS—Placing a strip of EASY-FLO between the pieces that make this tank gun firing mechanism part is a quick, reliable way to do jobs like this.

SHELLS—This job of making leak-tight joints between adapters and bodies is typical of the use of EASY-FLO on shells and other types of ammunition.

The silver brazing alloys . . . SIL-FOS and EASY-FLO . . . are doing a vital job in boosting war production. The exceptional speed and reliability of these alloys have won for them an important place in constructing planes, ships, tanks, guns, shells and other war equipment.

To meet the demands, our plant is turning out SIL-FOS and EASY-FLO in enormously increased quantities . . . working day and night — 100% for war production. And supplementing this all-out production, we are continually working with manufacturers all over the country, helping them plan their brazing operations to get the full benefits of the fast action and trouble-free results SIL-FOS and EASY-FLO are so capable of giving.

At the National Metal Exposition in Cleveland, we are going to carry on the same cooperative service we regularly give in the field. There will be SIL-FOS and EASY-FLO brazing demonstrations and many examples of war jobs these alloys are doing...and there will be a place to sit down and discuss **your** metal joining problems with brazing engineers and get specific information on the best procedures to follow.

THIS SAME SERVICE IS AVAILABLE TO ALL

If you do **not** attend the National Metal Exposition, remember we are always ready to cooperate in finding the right answer to a brazing problem. Send us full details and get our recommendations or ask for an engineer to demonstrate in your plant. Bulletin No. 12 tells the complete SIL-FOS and EASY-FLO story — write for a copy now

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ARMY E NAVY

ing. Torit Mfg. Co., St. Paul, Minn. **January, 1942.**

» «

Coppus Ship-Hold Ventilator. A portable unit for removing welding fumes and reducing the temperatures of confined spaces. Cast aluminum fan is capable of delivering 1,500 cfm of air; fan is driven by a ½ hp Universal motor. Complete unit weighs 80 lb and may be lowered through a 14 in. diam opening. Coppus Engineering Corp., Worcester, Mass. **March, 1942.**

» «

Welder Controls

Lincoln, Protective Device. A protective control device for arc welders, stated by manufacturer to afford complete protection against heat or excessive current. It is said that a welder equipped with this device can be operated for long periods of time at maximum capacity without harm. The Lincoln Electric Co., Cleveland. **November, 1941.**

» «

Model 41 Heat Control Unit. A heat control or weld current phase shifter unit for regulating welding current flow through an infinite series of graduated steps ranging from zero potential to full rated capacity. There are no tubes, condensers or relays. Heat changes may be made instantly, it is said. National Time and Signal Corp., Detroit, **December, 1941.**

» «

Dual Continuous Control. An improved and simplified design of the Lincoln Dual Continuous Control system for arc welders. The required adjustments are obtained through the use of self-indicating dials. Another feature is that both voltage control (job selector) and current control are in continuous operation. The Lincoln Electric Co., Cleveland. **January, 1942.**

» «

Welder Trailers

Hobart. A two-wheeled, light weight, pneumatic-tired trailer for transporting 200, 300 or 400 amp Hobart welders. It is easily handled by hand or by truck, at speeds up to 35 mph. Hobart Bros. Co., Troy, O. **February, 1942.**

» «

P&H. All-steel wheels have been substituted for rubber tires on this gas-engine-driven, two-wheeled trailer. The wheels have a 24 in. diam and 4 in. rim face and are designed to permit quick changeover to pneumatic tires when these later become available. Harnischfeger Corp., Milwaukee. **August, 1942.**

» «

Welding Electrodes, A-C

G-E Type W-26. An all-position electrode designed to render A-C arc welding practicable in the vertical and horizontal positions. It is available, or will be later available, in sizes from $\frac{1}{16}$ to ¼ in. Welding characteristics are said to be comparable to those of the reverse polarity D-C electrodes used for vertical and overhead welding. General Electric Co., Schenectady, N. Y. **July, 1942.**

» «

Welding Electrodes

Perfection. A complete line of arc welding electrodes which are guaranteed by manufacturer to conform to the requirements of recognized inspection agencies. Anthony Carlin Co., Cleveland. **February, 1942.**

» «

Armorac Type B. Said to be the largest welding rod now being manufactured, this coated electrode was designed expressly for welding tanks. It is ½ in. in diam and 28 in. long. Type B electrodes are also manufactured in sizes from ⅛ to $\frac{1}{16}$ in. Sizes of $\frac{1}{16}$ in. and larger operate on both A-C and D-C current. Alloy Rods Co., York Pa. **September, 1942.**

» «

Welding Positioners

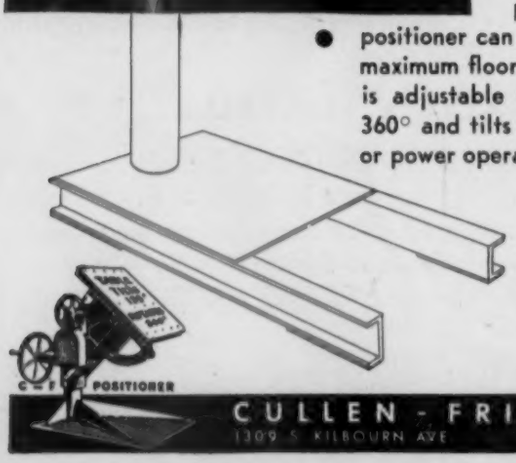
Heavy-Duty Positioner. This model has a working capacity of 18 tons and is full revolving as well as capable of tilting 90 deg. Tilting mechanism is driven by a 20 hp motor and table turning mechanism by a 10 hp motor. Positioner turntable is 13 ft 11 in. in diam; overall height is 8 ft. Mississippi Valley Structural Steel Co., Melrose Park, Ill. **October, 1941.**

(Continued on page 124)

WELDS ALL SIDES *DOWN-HAND* WITH ONLY ONE SET-UP

Place the weldment, regardless of size or shape, on a C-F Positioner. "Tack" it to the table and the welder can finish the job *alone*—can weld all sides down-hand without further crane work or jacking-up. With a C-F Positioner the welder himself rotates, twists and turns the heaviest and most cumbersome weldments with a push button control—can lay every fillet down-hand, assuring stronger, smoother, flawless welds "all over" easily and quickly.

Only the universal, multi-purpose C-F Positioners, both portable and stationary, are pedestal-mounted. The entire positioner can be rotated on its base to give maximum floor clearance or convenience and is adjustable for height. Table rotates full 360° and tilts to 135° from horizontal. Hand or power operated from 1200 lb. capacity up.



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1309 S. KILBOURN AVE. CHICAGO, ILLINOIS

The A-B-C of Corrosion and Heat Resisting Steels

Arrangement due to F. R. Palmer. Adapted from The Book of Stainless Steels, Second Edition

Group A (Martensitic)	Group B (Ferritic)	Group C (Austenitic)
Chemical Analysis Chromium less than about 16%; carbon less than about 0.40%. May contain small percentages of tungsten, copper, nickel, silicon, columbium, aluminum, and more frequently molybdenum. Group is magnetic.	Chromium more than about 16%; carbon quite low, but can increase as chromium goes up. May contain small percentages of copper, nickel, silicon, molybdenum, tungsten, nitrogen. This group is magnetic.	Contains enough nickel to make steel austenitic and non-magnetic. They usually contain twice as much chromium as nickel or vice versa; total alloy content at least 26%. Carbon quite low. (Manganese sometimes substituted for nickel, in part.)
Heat Treatment Respond to hardening and tempering. Resulting physical properties depend on chemical analysis (principally carbon content).	Do not respond. 18% chromium toughened by long anneal at more than 1400° F., and air cooling. Avoid decarburizing the skin. 25% chromium gets best strength and toughness by rapid cooling from 1650°.	Do not respond to hardening by heat treatment. Must be rapidly cooled from soaking heat at 1900 to 2150° F. to retain austenitic structure free of carbides. (Brinell 140 to 170).
Toughness Are structurally dependable. After tempering are not brittle in notched sections or under impact.	Laminated structure, from coarse ferrite in ingot, causes low impact values, but proper rolling and heating gives adequate toughness in rods, bars, and sheets. Structure is refined by alloying with nitrogen.	Extremely tough at all temperatures down to liquid air. Dependable against shock except when corroded at grain boundaries (a preventable condition)
Grain Growth and Structural Changes at High Temperatures Not subject to excessive grain growth. Thoroughly dependable for supporting any load or shock within their carrying capacity up to 1400° F. Brittleness in plain chromium steels when cooled after long heating is avoided by addition of molybdenum.	The chromium-irons low in carbon and those high in silicon or aluminum (when cold worked) are subject to excessive grain growth, especially above 1900° F. Grain growth reduced by nitrogen. Long service at 800 to 950° F. makes them brittle when cold, although they are not brittle at working temperatures.	Alloys near the austenite-martensite border line tend to precipitate carbides at grain boundaries during service at 800 to 1600° F., losing some toughness and becoming susceptible to intergranular attack. This is controlled by very low carbon, by titanium or columbium, by increasing the chromium and nickel, or by prior "stabilization."
Strength at Elevated Temperatures Much better than straight carbon steel for temperatures up to 1000 or 1200° F Retain tensile properties up to 750° F.	Heat resisting varieties quite tough at temperatures up to 1600° F. Superior in ductility to Group C but not in creep resistance.	Have high creep strength up to 1200° F. which is enhanced by tungsten or molybdenum. Toughness impaired in non-stabilized alloys by service at 800 to 1600° F.
Hot Working Qualities Readily forged, pierced, or rolled at 2000 to 1700° F. Preheat and soak stock at 1600° F. Plain chromium alloys air harden on cooling.	May be forged, rolled, or pierced. Should be heated quickly. Forge from 2200° F. down to 1750° F. On last heat continue cold working to 1400° F. to refine grain. Alloys do not air harden.	May be forged, rolled, or pierced. Preheat and soak at 1600° F., heat quickly to 2200° F., forge down to 1850° F. Hot short range: 1800 to 1300° F. Alloys do not air harden.
Cold Working Qualities Low carbon varieties can be easily cold drawn into wire, cold rolled, bent, formed, upset, coined, and deep drawn.	Can be cold drawn into wire, cold rolled, bent, formed, upset, coined, and deep drawn, especially when warm (300 to 500° F.).	Can be cold drawn into wire, cold rolled, bent, formed, upset, coined, and deep drawn. Work-harden twice as rapidly as Groups A and B.
Machinability Machine satisfactorily with properly designed tools when heat treated to 200 to 250 Brinell. Free-cutting grade contains complex sulphides or selenium.	Machine satisfactorily with properly designed tools. Cold working and high sulphur or selenium improve machinability.	Most difficult of all even with super high speed and carbide tools. Use sharp tools having greater top rake than usual, and cut continually. Free-cutting grade contains selenium and phosphorus.
Riveting Make excellent cold rivets. Air hardening, high chromium steels not recommended for hot rivets driven above 1500° F.	Extra precautions required to avoid brittle rivets. Conical heads should be cold upset on ground bars; rivets driven at 1425° F. into chamfered holes.	Excellent for either hot or cold rivets. Hot rivets may be driven at a high temperature (1900° F.).
Welding Properties Preheated parts can be welded with gas, electric arc, or resistance Anneal immediately before weld air hardens. Little grain growth. Columbium or aluminum increases ductility of welds.	Can be welded. Anneal at 1450° F. to reduce embrittlement alongside weld. Those metals subject to grain growth are brittle adjacent to the weld. Those metals not subject to grain growth yield satisfactory welds.	Can be welded with gas, electric arc, or resistance, if carburization is avoided. Weld does not air harden, and is very tough. Only the relatively low carbon or "stabilized" metal should be welded if article must resist corroding media.
Corrosion Resistance Increases with chromium content; inferior to Groups B and C Resists weather, water, steam, and mild corrodents when chromium is 11.5% or more. If carbon is relatively high, metal must be hardened and tempered (below 1000° F.).	Possess corrosion resisting properties superior to Group A; increases with chromium content, Especially good for nitric and other oxidizing acids.	Corrosion resistance depends largely upon total alloy content. Resists nearly all corrodents measurably better than Groups A and B; especially good for organic acids Severe pitting may occur in stagnant chloride solutions under particles of foreign matter and along faying surfaces.
Scale Resistance Increases with chromium content. Generally useful for continuous temperatures up to 1200° F., and in some services up to 1500° F.	Superior to Group A, especially when chromium is above 25%; then resist reducing atmospheres up to 2100° F., resist oxidizing gases up to melting points, and sulphur gases up to 1800° F.	Excellent where combination of high temperature and corrrosion is to be met. High chromium, low nickel alloys required to resist sulphurous gases. Addition of 2 to 3% silicon markedly improves scale resistance.

Down in the belly of a sub . . . with countless tons of crushing water between men and the blue sky . . . *safety* takes on a new meaning!

For the tiniest flaw could spell disaster when pressure skyrockets as the ship descends.

Aware of the grave responsibility imposed on arc welds, McKay Shielded-Arc Electrodes are made with a maximum of skill and care, and inspected with never-relaxing vigilance.

Here, as in other vital phases of war time marine construction, the advantages of the McKay "Researched Line" are demonstrated daily . . . advantages destined to make welding a safer, better, easier, cheaper production and construction method later.

THE McKAY COMPANY · PITTSBURGH, PA.

PACIFIC COAST SALES OFFICES: 125 S. Santa Fe Ave., Los Angeles · 100 Howard St., San Francisco

The McKay line includes regular carbon steel, stainless, and alloy steel electrodes for every welding purpose. Literature on request.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

★ The McKay Company was among the first honored with the coveted Navy "E" award for excellence in fulfilling Naval Ordnance contracts. ★

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McKAY WELDING ELECTRODES

AND INDUSTRIAL, MARINE AND AUTOMOTIVE CHAINS

New Products to Use

Remote Control

★ **Hobart Brothers Co.,** Troy, O., has developed a new welder control unit which is now a standard production feature of all arc welders offered for sale by this company. This "remote control"

Remote control unit for Hobart welders. Welding heat may be increased or decreased and voltage changed without going near the machine.

unit permits the changing of machine adjustments without the necessity of repeated trips between work and machine; it places 100 steps of fine voltage-amperage adjustment within reach of the weldor's hand. An ordinary lamp cord extension will connect the control to the welder, and the unit is protected from accidental breakage by a metal "pull-out" handle set over the control dial and by cushion springs on the back of the porcelain rheostat.

In the accompanying picture, the large outer control dial is the field rheostat which controls the differential compounds while the remote control unit adjusts the open circuit voltage. Manufacturer states that 1,000 combinations of voltage and current are possible with this new device.

» «

New D-C Electrode

★ A new shielded-arc type, heavily coated electrode has been announced by **The Lincoln Electric Co.,** Cleveland. Designated as **Fleetweld 11,** it is said to be a fast flowing electrode, giving deep penetration and designed to complete a weld in one pass. Fleetweld 11 is made in 18 in. lengths and two diameters, $\frac{1}{8}$ in. and $\frac{1}{4}$ in.

Portable Power Saw

★ The **"Saw-Gun"** is a sawing and filing attachment for an electrical, flexible shaft or air-operated drill. It may be used, states manufacturer, for panel notching, slotting or similar operations on stainless steel, Monel metal, corrugated or plain steel sheets, and it will saw or file heavy sheet metal, castings or rods in spots inaccessible to other tools. This tool should be operated by a drill of 2,000 rpm or more. **Mid-States Equipment Co.,** 2137 S. Wabash Ave., Chicago.

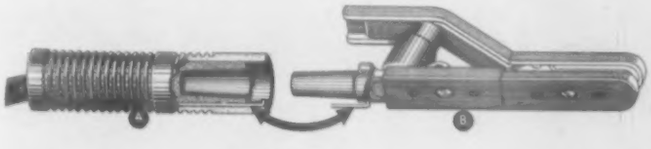
» «

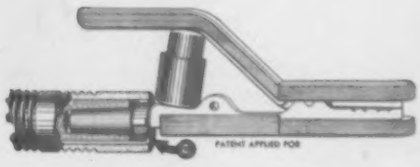
Electrode Holder

★ **Jackson Products,** 3265 Wight St., Detroit, is introducing a new insulated **welding electrode holder** with detachable "stinger." The female section of the cable connector is permanently soldered to the cable lead and remains in the insulated handle ("A" in accompanying illustration). The detachable jaw section, the stinger ("B"), is snapped into the female section by a quick twist of the weldor's wrist. The actuating cam mechanism that locks male and female sections together is shown at "C." The lock may be quickly disengaged.

Manufacturer claims that the use of this holder, the Jackson "Quik Trik," eliminates waste of time in changing cable connections and does away with dangerous loose cable ends kicking about when the stinger end is detached. When necessary, the handle and the cable may be pulled through a small hole and the stinger then connected, saving time and cable extensions.

The new holder is made in three models, all insulated: Model TA-1, 300 amp with stationary jaws; Model TA-2, 300 amp with replaceable jaws of Mallory 3 metal; Model TA-3, 500 amp with replaceable jaws of Mallory 3 metal.

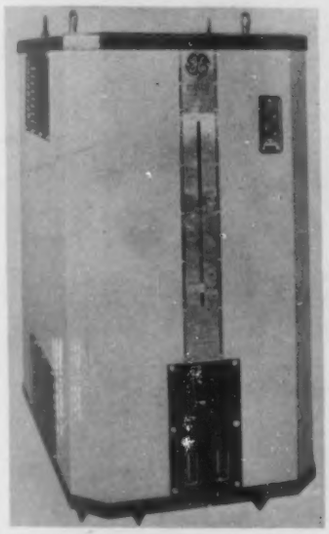




Jackson "Quik Trik" electrode holder. Stinger end, "B," may be disengaged with quick twist and turned in at end of shift for inspection.

Unionmelt Transformers

★ A line of heavy-duty A-C **welding transformers** especially designed for welding by the automatic arc (Unionmelt) process is announced by the **General Electric Co.** These are available in



G-E arc welding transformer, Model 6WK3C1, 60 cycles, 1,000 amp, 440/550 to 80 volts.

750 and 1,000 amp sizes for 220, 440 and 550 volts.

Features of this new line are built-in capacitors and built-in primary control. The capacitors improve voltage regulation of the power feeders, thus aiding to secure uniform welding. The built-in primary control simplifies wiring and is advantageous in portable installations because of its compactness.

The integral reaction design of this equipment permits full output to be obtained without the use of high or multiple open-circuit taps. Motor-operated remote adjustment of the welding current allows a welding operator to make current adjustments without leaving the work. A large-calibrated scale on the front of the case indicates the current output of each welding transformer.

» «

Welding Cables

★ **Special Welding Alloy Co., Inc.,** 27-26 Jackson Ave., Long Island City, N. Y., is now offering welding cables to meet Navy Specifications No. 15-C-3B and amendments with regard to cable sizes, strandings and outside dimensions. **"Spe-Weld cables** are made of stranded No. 34 bare copper strands; separator is of a special treated paper, and a tough insulation compound has been developed to withstand abrasion, impact and the action of oils, grease or other destructive agents.

Welding and Brazing Fluxes

★ A new line of a dozen welding and brazing compounds is being offered by **American Products Corp.,** 422 S. Dearborn St., Chicago, under the trade name, **"Xcel-Flux."** Among these fluxes, the following are especially noteworthy:

"SS" (paste) for silver soldering and gas welding of Monel metal, Inconel, stainless iron, stainless steel, nickel and all nickel-chrome alloys. This flux meets with U. S. Navy Spec. No. 51F4a.

"B" (powder) for bronze welding and brazing. This flux is for general use, giving excellent results, states manufacturer, on brass, bronze, all types of copper, malleable iron and steel.

"FFG" (paste) for brazing and silver soldering cutting tool metals—Stellite, Ramet, Tantalum, Carboloy, vanadium alloys, etc.—to tool shanks. This flux is also used for brass, copper, copper alloys and extruded nickel silver.

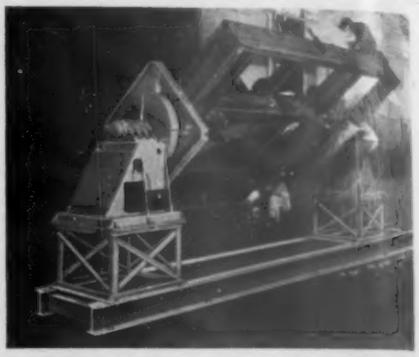
"C" (powder) for cast iron welding with cast iron rods. This flux prevents oxidation and is said to produce a finer-grained, softer, more ductile weld structure. It provides a slow temper cooling which makes weld cracking impossible, states manufacturer.

» «

REGO
REGO
RegO approved welding and cutting equipment beats every operating test, offers greater utility, assures utmost economy . . . and meets every price comparison. The complete RegO line also includes manifolds, regulators, valves and fittings to meet every requirement. Experienced RegO engineers are at your service.
REGO
Manufactured by
The BASTIAN-BLESSING Co.
4245 Peterson Avenue Chicago, Ill.
Insure perfect performance and economy by insisting on genuine Bastian-Blessing products identified by the RegO trademark.

Welding Positioner

★ A rotating welding fixture for position-welding of large cumbersome objects has been developed by the Industrial Division of the **Ransome Machinery Co.,** Dunellen, N. J. Fixture



Adjustable positioner for handling large weldments. Tailstock may be moved toward and away from the headstock; sub-bases may be changed to give different heights.

consists of a headstock and tailstock mounted on heavy I-beams. By moving the tailstock, the distance between the two units may be varied to accommodate objects of different lengths. Height adjustments are accomplished with equal simplicity through the use of sub-bases which may be varied to suit the weldment (see illustration).

The headstock is provided with power for rotating the table top, which is fixed in a vertical position; driving motor and self-locking gear reduction are enclosed within the main frame. The tailstock is not provided with power and functions simply as an outboard holding fixture. Both units are of heavy all-welded construction, and the table tops are T-slotted to facilitate clamping.

The main base of the two units is pivoted at one end and provided with a hydraulic jack at the other. Thus a difference in elevation between headstock and tailstock may be attained, if this is desired to provide additional downhand welding positions.

» «

Magnifiers

★ Four new models of "Super Sight," a **lighted magnifying lens combination,** are announced for such work as close inspection, small parts assembly and precision machining.

No. 95ZC has two magnifying lenses, upper 5 in., lower 4 in., lighted separately. Either or both may be used as occasion demands. No. 89ZC has one 5 in. magnifying lens. No. 44ZC has one 4 in. magnifying lens. All of these three models have head balanced to bracket and can be put in any position over a wide bench area. No. 89U, for precision machining, has one 5 in. magnifying lens and is fitted with a safety-guard lens. This model is equipped with Universal clamps.

Further details may be obtained from **The Boyer-Campbell Co.,** 6540 Antoine St., Detroit.

Awarded the Navy "E" for excellence in war production, P&H displays it also as a pledge of future effort.

NOW- without priority!

ALLOY ELECTRODES FOR MAINTENANCE AND REPAIR

Of course, war production comes first! But America's machinery producing for civilian life must keep running, too! That's why the U. S. Government (through Limitations Order No. 146) makes it possible for you to secure, *without priority*, the welding electrodes necessary for maintenance and repair work.

Our fullest co-operation makes possible a limited percentage of our production of P&H Alloy Electrodes for this purpose. These include such indispensable electrodes as P&H "Harcote" for hard-surfacing to resist wear and give new life to many parts. Numerous other electrodes also are available to answer every need for resisting wear, abrasion, and impact; for welding stainless steels; 4-6% chrome steels, etc. The only restriction is that they must be used for maintenance and repair.

P&H FOR ALLOY ELECTRODES

HOW TO ORDER—

Write us; we will send you information on how to obtain P&H Alloy Electrodes; also data sheets on how to select and use them.

General Offices: 4513 W. National Avenue, Milwaukee, Wisconsin

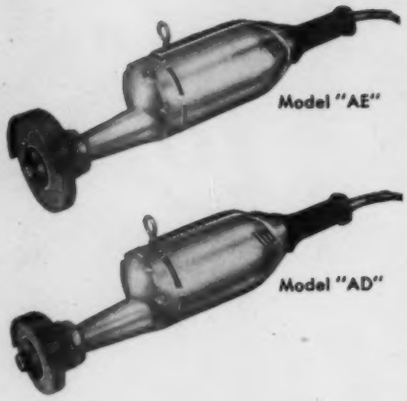
HARNISCHFEGER CORPORATION

WELDING ELECTRODES • MOTORS • HOISTS P&H ELECTRIC CRANES • ARC WELDERS • EXCAVATORS

Canadian Distribution: The Canadian Fairbanks-Morse Company, Ltd.

Portable Grinders

★ Two new portable grinders have just been added to the line of electric tools made by **Skilsaw, Inc.**, Chicago. These are **4 in. and 5 in. grinders** designed to meet high speed requirements on all kinds of grinding, wire brushing, polishing and buffing operations. Model "AD," the 4 in. grinder, is 22 in. long, weighs 15 lb, operates at a no-load speed of 4,500 rpm and drives a grinding wheel 4 in. by ¾ in. by ½ in. Model "AE" weighs 18 lb, is 22⅝ in. long, operates at 4,200 rpm and has a grinding wheel 5 in. by ¾ in. by ½ in. Construction features are: ball bearings mounted in steel inserts on armature and extreme ends of wheel spindle; commutator and switch fully enclosed for protection against dust; heat-treated steel gears, spline-mounted on shafts; universal motor and rubber sleeve handle.

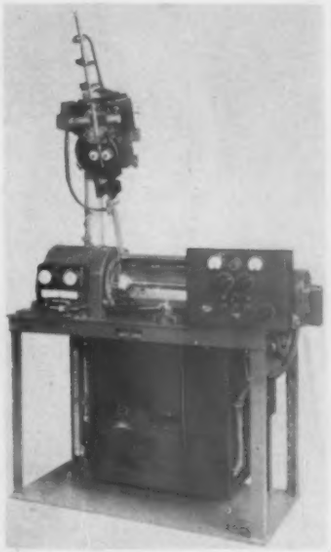


Models "AD" and "AE," 4 in. and 5 in. grinders, respectively, were designed to meet today's high speed production requirements.

» «

Automatic Arc Welder

★ Complete equipment for automatic arc welding with coated electrodes in cut lengths is announced by the General Electric Co. With the essential elements of this equipment, automatic arc welding heads originally designed for operation with thyratron-controlled coiled electrodes can be converted for successful welding with stick electrodes.



Equipment for automatic arc welding with stick electrodes. Set-up shown here is for an edge weld on hemispheres for a float valve chamber.

The new welder is particularly suited to work where one or more complete joints can be made with a single electrode, and it has been used to make edge, lap, fillet, and groove welds. Applications have included the welding of machine gun water jackets, tank wheels, ordnance shells, and refrigerator parts.

The equipment is sirailar to that used for welding with coiled electrodes except for the electrode feed rolls and electrode guiding device. A clamp which will hold any standard stick electrode is attached to the end of a feed rod upon which two feed rolls operate to maintain the proper arc voltage through automatic thyratron control. The electrode is accurately guided to maintain the arc in a predetermined location. The equipment strikes and maintains the arc, feeding the electrode at the proper rate to maintain the preset arc voltage. Welding continues until stopped by a limit switch, at which time the electrode clamp returns to starting position to receive a new electrode.

Geared for **WAR** *today —or* **PEACE** *tomorrow*

Through two wars and for almost half a century, The Alexander Milburn Company has been serving Government and Industry. Milburn Equipment may be relied upon for superior, dependable service under stress of the most adverse conditions.

Write for Catalog.

The ALEXANDER MILBURN Company

1403 W. BALTIMORE ST., BALTIMORE, MD.

Fire Extinguisher Attachment

★ For magnesium incendiary bombs and certain industrial fires which must be fought with a spray as well as a solid stream, the Pyrene Mfg. Co. has developed a **"thumb-spray" nozzle attachment** which clamps over the ⅜ in. hose and nozzle of any standard soda-acid, foam, gas cartridge or pump tank fire extinguisher. The normally solid stream from a standard extinguisher is then converted into a spray by applying pressure with the thumb at the end of the attachment. Device is easily attached by sliding a welded clamp over the hose and ferrule of the extinguisher until the end of the "thumb-spray" extends 1¼ in. from the end of the nozzle. A nut and bolt holds it permanently in position, and the extinguisher itself is not affected. **Pyrene Mfg. Co.**, 560 Belmont Ave., Newark, N. J.

Present fire extinguisher equipment may be adapted for use on magnesium incendiary bombs by the attachment of a "thumb-spray."

» «

Fire Extinguisher

★ This new 100 lb **carbon dioxide engine** is recommended for fires in inflammable liquids, electrical machinery and for other class "B" and "C" fires. It smothers such fires with non-corrosive, non-poisonous carbon dioxide gas, which expands upon discharge to 450 times its stored volume. Engine is equiped with an "Anti-Statik" horn to protect the operator from static charge and has a retaining latch which will release horn instantly yet hold it firmly in place when not in use. **American-LaFrance-Foamite Corp.**, Elmira, N. Y.

Alfite 100 lb carbon dioxide fire engine. It has a third swivel wheel for easy maneuvering.

» «

Respirator Cartridge

★ The **"Mersorb" filter cartridge** for use with chemical cartridge respirators is said to provide protection for 70 hr against light concentrations of metallic mercury vapors. The M.S.A. chemical cartridge respirator for which the new cartridge is designed is a low resistance, twin-cartridge-type respirator, used for protection against light concentrations of organic vapors and acid gases. Further details are available on request to the **Mine Safety Appliance Co.**, Braddock, Thomas and Meade Streets, Pittsburgh.

» «

Aircraft Welding Electrode

★ A new electric arc welding electrode to be known as **Harcraft** has been added to the P&H line. It will be supplied in a complete range of sizes in standard cut lengths. Physical and chemical properties and welding procedures will be given on request to the **Harnischfeger Corp.**, Milwaukee. The electrode is designed primarily for welding aircraft tubing and assemblies.

Another strong, clean weld by Acme Welding Works, Indianapolis. Not the least important part of this 15-year-old welder is the Pierce Flyball Governor. (See inset.) Built by Acme, the welder has a Cutler-Hammer generator unit, powered by a Continental motor. The governor is gear-driven off the front of the timing gear.

HOW TO MAKE YOUR GOVERNORS LAST!

Like others manufacturing for war needs, Pierce production is for war and essential industry. For this reason new governors can be supplied only on a priority basis. But Pierce calls attention to these easy measures which will make your present Pierce Governors last and give the best service.

- **CLEAN GOVERNORS** once a month with kerosene, gasoline, or prepared cleaner.
- **INSPECT AND CHECK GOVERNORS** each week when in continuous operation.
- **CHECK OIL LEVEL** every day in manually lubricated governors. SAE 20 Oil is recommended at this time of year.
- **LINE UP** driving pulleys or gears accurately when reassembling governor after cleaning.

Should your governor need repair or reconditioning send it to the factory with the necessary preference rating certificate.

"No Governor Trouble in 15 Years Service!"

● That's the experience of Jack Priest, head of Acme Welding Works of Indianapolis, with Pierce Flyball Governors. He says, "We build up our own complete welding rigs, and we always use Pierce Flyball Governors. They give perfect speed regulation, which holds the arc constant without fail, and gives split-second recovery of current characteristics—within three-tenths of a second—after striking arc! One of our welders is 15 years old, and the governor is still giving perfect service."

THE PIERCE GOVERNOR COMPANY
1607 OHIO AVENUE, ANDERSON, INDIANA

Pierce Governors
STANDARD SINCE 1914

Weldors' Clamps

★ The "loose-pin" or "bar" handle has now been adopted as standard on the No. 120 series of **"Jorgensen" body clamps.** This type of handle provides greater leverage and is the handle that

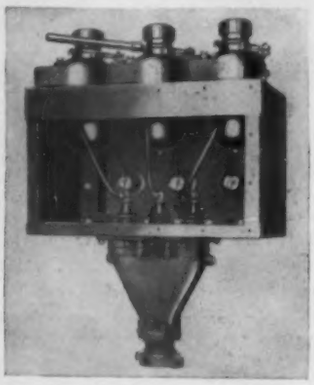
"Jorgensen" clamp, No. 120 series, with new bar handle for greater leverage.

weldors are accustomed to on their stronger clamps. Formerly this clamp series used a wing-nut, which is now available as an optional form. The 120 series, states manufacturer, does not depend upon heat treatment for its strength, so that these clamps are not "spoiled" when left too close to the weld and heat. **Adjustable Clamp Co.**, 417 N. Ashland Ave., Chicago, Ill.

» «

Oil Fuse Cutouts

★ **General Electric Co.**, Schenectady, N. Y., announces a new metal-enclosed assembly of **gang-operated oil fuse cutouts** for short-circuit protection and switching. These new cutout assemblies can be supplied for wall or direct-to-apparatus mounting. They are particularly well adapted, states manufacturer, for use (indoor or outdoor) in industrial plants for branch circuits, individual transformers or banks, motors,



New G-E metal-clad oil fuse cutout assembly.

control apparatus and electric-heating and other equipment.

» «

Ferrule Resistors

★ **Ferrule-type resistors** have many applications in industry. In this new line, designed for easy interchangeability without tools, a winding of resistance wire on a ceramic core is protected by a vitreous enamel coating. The wire terminates on metal bands or ferrules (of the cup, sleeve or cartridge type) for mounting in fuse clips.

Ferrule resistors. These have special ceramic cores, some of which will withstand the temperature shock test of repeated alternate immersions in ice cold and hot water. Other protective coatings will pass salt water immersion tests.

Further details may be obtained from the **Ohmite Mfg. Co.**, 4835 Flournoy St., Dept. 3C, Chicago.

» «

Plastic Insulators

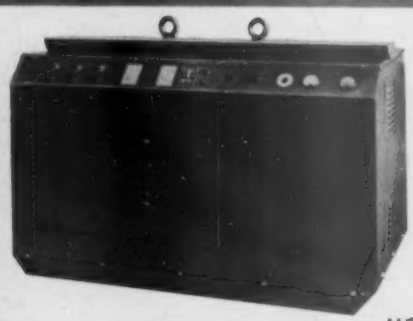
★ **Mueller Electric Co.**, 1583 E. 31st St., Cleveland, offers these new plastic insulators for use with Mueller Universal clips. The insulators, put on the market in order to help conserve rubber, are said to have a high dielectric strength and to offer excellent resistance to heat and oil. They carry the same code numbers (except for the suffix "P") as the regular rubber insulators for which they may be substituted.

G-R BUILDS FOR THE FUTURE

ALTHOUGH busy producing the greatest volume of G-R Welders in its history, the GLENN-ROBERTS COMPANY is constantly engaged in research to effect improvements in a. c. welder design. Every G-R, from the smallest hand-operated machine to the largest automatic will make good on this pledge:

The G-R Welder you buy today will be an efficient modern tool for many years to come.

ONLY G-R Welders utilize the principle of flux diversion in the transformer core to regulate current output. This gives *full-range stepless control.* High efficiency; a quick-starting stable arc easily handled in all positions and absolute safety for the operator are other "plus-values" that G-R owners get.



MODEL 77

BEFORE YOU BUY A WELDER SEE THE G-R IN ACTION!

A size and model for every welding job, manual or automatic. Models from 125 to 2,000 amperes maximum output... Power Factor Corrected.

See your G-R Distributor, or WIRE, WRITE or PHONE

GLENN-ROBERTS COMPANY

HOME OFFICE & FACTORY: 1009 FRUITVALE AVENUE, OAKLAND, CALIFORNIA
CHICAGO, ILLINOIS, 5651 W. Ohio Street · WASHINGTON, D. C., P. O. Box 1814

AND Your Meco Regulator WAS SHIPPED TO... SHANGRI-LA

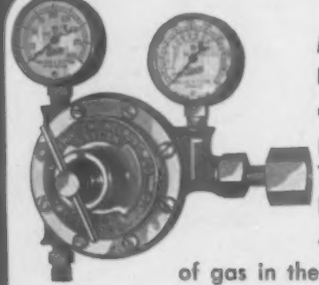
Shangri-La—means "most anywhere"; a term coined by the President to let the enemy do *all* of the guessing.

Where is it? The regulator we had made to ship to you, and didn't, might be anywhere... a hidden airfield in China where American Pilots come in for service... the bowels of an American submarine some place in the Pacific... the repair ship of a convoy fleet... or an airplane plant somewhere in the U. S. A.—turning out bombers and fighters, to make Hitler, Hirohito and Mussolini sweat.

☆ ☆

☆ The Meco Catalog covers the complete range of Meco Cutting, Welding, Brazing and other equipment used in all gas processes. A copy will be mailed at your request.

WRITE TODAY!



Meco Safe-T-Chek Regulators are equipped with the patented Meco Safe-T-Chek Valve which helps minimize wear and cuts off the flow of gas in the event of valve seat failure. All Meco High Pressure Regulators have *four* seats in place of one.

Meco

Welding Cutting

MODERN ENGINEERING CO.

3413 PINE BOULEVARD ST. LOUIS, MISSOURI

All-Position A-C Electrode

★ **A new electrode, No. 530,** for all-position welding of mild steel with A-C type welders has been developed by **Wilson Welder and Metals Co., Inc.,** 60 East 42nd St., New York City. Available in diameters of $\frac{1}{16}$, $\frac{5}{32}$, $\frac{1}{8}$ and $\frac{5}{32}$ in., this electrode is stated to meet all requirements of the American Welding Society Classification E6011, American Bureau of Shipping, Group H1G and B1G for A-C and other specifications qualifying it for use on war work. Physical test results made on all-weld-metal tensile specimens show ultimate tensile strength of 70,000 to 75,000 psi as welded and 65,000 to 70,000 psi when stress relieved.

» «

Designed for quick interchangeability of mounting, either trolley, hook, rigid or bolt, the P & H Zip-Lift can also be parallel or cross mounted.

One-Ton "Zip-Lift"

★ Harnischfeger Corp. has now included in regular production the 2,000 lb. **Zip-Lift hoist** heretofore available only on special order. The one-ton model is equipped with the same features as the 250, 500 and 1,000 lb. models: full magnetic push-button control, preformed non-spinning hoist cables, three-way interchangeable mountings, safety type limit switch, double brakes, fully enclosed dust-and-weatherproof construction.

Descriptive literature is available from the **Harnischfeger Corp.,** 4513 W. National Ave., Milwaukee.

» «

Cleaning Solution

★ Metal cleaning has become something of a problem because of the current scarcity of chlorinated solvents and more exacting specifications. A recent formula for difficult metal cleaning of light steel makes use of a 1% solution composed of 19 parts sodium metasilicate (Metso) and 1 part alkyl aryl sulphonate (Nacconol NR). The latter material is said to reduce surface tension and assist the Metso solution in the removal of the grease film with only 2 seconds contact. Further information may be obtained from the **Philadelphia Quartz Co.,** 121 S. Third St., Philadelphia.

» «

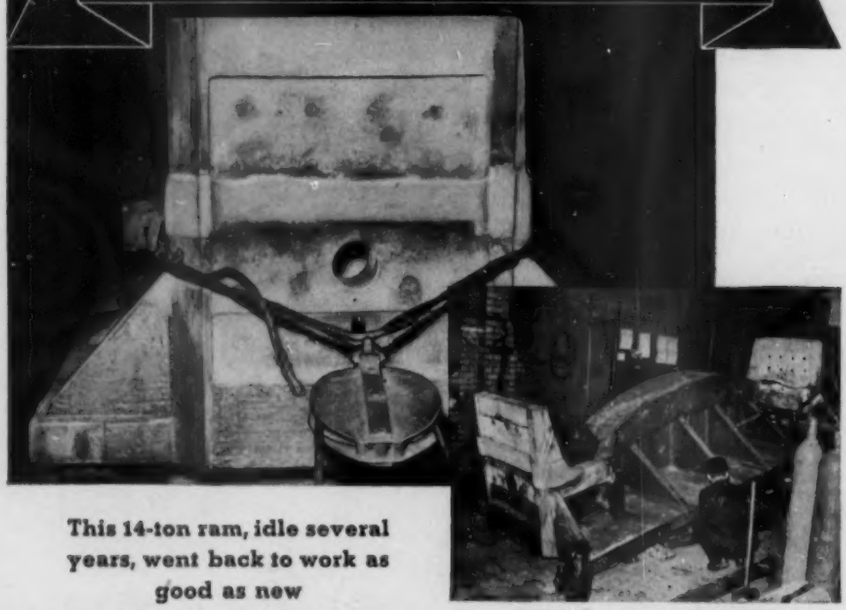
Safety Clothing

★ To protect weldors against painful burns and dangerous exposure to molten metal sparks, **American Optical Co.,** Southbridge, Mass., offers a new and wide assortment of **chrome tanned leather clothing** that will keep hot sparks away from the skin and normal work clothes. This new safety clothing, states manufacturer, has been designed by an expert weldor of many years' experience and is built to give maximum protection, a comfortable fit and long wear. Each article is made of as few pieces of leather as possible in order to eliminate "piecing out" and unnecessary seams.

New safety clothing to protect weldors against metal sparks.

The line includes overalls, all-leather pants, hot weather pants, chaps, split leg apron, one piece apron, coat, cape sleeves and bib, short jacket, weldors' sleeve, spats, gloves and mittens, sleevelets and various complete protection combinations. All of these are pictured and described in a new catalog, available on request.

Speeding war work through Tobin Bronze Welding!



This 14-ton ram, idle several years, went back to work as good as new

Rams of this size take months to manufacture and deliver. So, when this one was found coincidentally with a call from a war job for such a piece of equipment, everyone felt quite happy... for awhile. Inspection revealed a badly patched fracture which probably occurred many years ago.

Undismayed when it examined the ram, the Super Arc Welding Company of Detroit set out to put the equipment into first-class operating condition... by Tobin Bronze Welding. After three days of adjusting the parts, they started preheating and welding. Three days later, with the help of 1750 pounds of Tobin Bronze, this ram went to work on war production.

• • •

Tobin Bronze and other Anaconda Copper-Alloy Welding Rods are always "on call" for war production work. 4297A

ANACONDA *Anaconda Welding Rods*

THE AMERICAN BRASS COMPANY—General Offices: Waterbury, Conn.

Subsidiary of Anaconda Copper Mining Co. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

Welding's Dreams Come True

A message to manufacturers of welding equipment and supplies

Joining separate pieces of similar and dissimilar metal as one, merely by use of an electric current, or two common gases, is as dynamic a phenomena as could be visualized. The alchemists' search for the "philosopher's stone" would not have been rewarded better than had they discovered such a simple means of joining metallic substances.

It is only natural that with the development of welding into its crude state also came visionaries—dreamers of the fabricating marvels that would some day be performed as a matter of course by welding. Dreams of welding whole hulls of ships . . . of using giant electrodes . . . of welding magnesium and aluminum . . . of patching up unavoidable defects in castings . . . . of these and innumerable other "impossible" tasks done by welding.

The stark reality of war has crystallized many dreams of welding. Unfortunately, in the flurry of excitement created by speedy completion of the ends —tanks, ships, armament and the like—the means that have made this possible are only passingly acknowledged, if at all.

America has to catch up with nine years' preparation of one enemy and more than that of another. Years of preparation have put effectiveness on the battlefield and make it doubly difficult for us to catch up. America must build for victory without countless essential products and with scarcities of many, many others. Shipping must function through submarine infested waters. Industries must continuously operate closer to capacity than ever before without replacements of obsolete and obsolescent machinery.

Yes, this could be a bitter picture of frustration—frustration becoming doubly worse as time goes along.

But the lead will be overcome, the pinch of scarcity will be overcome, the dead weight of machinery obsolescense will be overcome by help of the process so proudly dreamed about for years and years. Now welding's dream has become a reality. And by this it is serving better than it ever could have.

Those men who a quarter of a century ago were the first to visualize of what tremendous importance welding could some day be are now recognized as the pioneers of the welding industry. And it is significant that from their time until the present THE WELDING ENGINEER has paved the way for expansion and realization of welding's dreams. As a leader of the industry said several years ago, "When we now consider what a boon welding has become and recall that welding did not make "THE WELDING ENGINEER," but rather, "THE WELDING ENGINEER" made welding, let us not forget the debt of gratitude we owe to this splendid publication."

Manufacturers of welding equipment and supplies also may have been dreamers when they set out to gain general acceptance in welding. Among today's leaders are those listed on the opposite page. Their dreams of a future in welding, flame cutting and brazing also have come true and in no small measure because of the use they have made and are continuing to make of THE WELDING ENGINEER.

As we dedicate this issue to another Annual Metal Show—America's first at war—we can pause for a moment to notice another dream of welding tucked away in the minds of those now busy on war production. Just as the elephant would not be without his trunk now that it has been put right on the end of his nose, American industry won't be without welding when it can return to the things it wants to do. Welding's future will be as firmly its application for making products of peace as it has come to be the alchemy of production for war. Manufacturers of welding equipment and supplies will then find that their customers, now making armament, will continue using welding to fabricate peacetime products. And then the welding engineer, the metallurgist, the welding supervisor will be the heart of how peacetime products are fabricated.

These men have gained the confidence of their management by dependence upon welding for Victory. They have shown management what can be done by welding, flame cutting and brazing. Their ingenuity will be used for peacetime products as well.

And for the present, while these men are performing their vital production role, manufacturers of products they use should make sure they have a full appreciation of how to get most value out of welding equipment and supplies. That function should be performed right now. It's the contribution the welding industry will notice now and not forget in our post war world. Here is a service manufacturers of welding equipment and supplies should not put off for brighter days to come. Doing this job now is putting action into your dreams of tomorrow.

THE WELDING ENGINEER

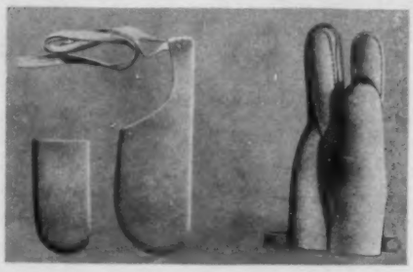
Pioneer Business and Technical Journal of The Welding Industry

New York, N. Y. 1834 Broadway | Chicago, Ill. 506 So. Wabash Ave. | Los Angeles, Calif. 400 E. Third St.

KEEP BUYING WAR BONDS AND SAVINGS STAMPS

Finger Protectors

★ Three new types of chrome **leather finger cots** are now being offered by the **American Optical Co.**, Southbridge, Mass. The AO 1000 finger cot (short type) is recommended for operations in which only one or two fingers need to be protected. The second type—the No. 1001—is of the tie-on type, unusually large, and can be used as a protection for a bandaged finger or thumb. The third type—the No. 1688 two finger and thumb protector—is recommended for operations where several movements require finger protection while succeeding movements require the accuracy and sense of touch of a bare hand.



Three new finger cots. Left: short type; center: tie-on; right: two finger and thumb protector.

Women Weldors' Garments

★ Women weldors will now be afforded adequate protection through a new line of **Saf-T Weldors' Garments** which have been introduced by **Fred Jessar**, 404 Denckla Building, Philadelphia, Pa. These light weight garments for women are made of an especially tanned leather having high heat resistant qualities. In addition to women's garments, these Saf-T weldor garments are available for men and include capes, sleeves, jackets, overalls, and gloves.

» «

Low Pressure Spot Welder

★ **Progressive Welder Co.**, Detroit, is introducing a **spot welding gun** especially designed for welding brackets or clips to light gauge alloy steels, where light welding pressure is required in order not to deform the metal. Operating pressure is hydraulic with partially counterbalancing continuous air pressure. Screw-adjustable stroke (up to 3 in.) and interchangeable adapters for electrodes are other features. Gun is suitable for a wide variety of work shapes, states manufacturer.

Close-up of new Progressive welding gun for spot welding of light gauge alloy steel.

» «

Potassium Silicate Solutions

★ Two new grades of potassium silicate, **Kasil No. 2 and Kasil No. 6**, are announced by the **Philadelphia Quartz Co.**, 121 S. Third St., Philadelphia. These are specially concentrated solutions, developed primarily for the manufacture of welding electrodes by the extrusion method of production. No. 2 is a 32 deg Baume product with the molecular ratio of 1: 3.92, and No. 6 is 40.5 deg Baume, molecular ratio 1:3.29. Both grades are offered in steel returnable drums as well as in single trip packages.

» «

Protective Clothing

★ The S.C. Leather Co., 819 Fifth Avenue, Pittsburgh, Pa., announces a new line of leather clothing for the protection of women weldors. This addition to the Essee line of safety products includes the same garments which have for long been available to weldors: that is, coats, sleeves, overalls, pants, capes, cape sleeves and aprons.

News of the Industry

AWS Issues New Instruction Code

The American Welding Society has issued a new "Code of Minimum Requirements" for instruction in the arc welding of steel ⅛ to ¾ in. thick. This is a revision of the "proposed code" issued by AWS in 1941 and adopted by the War Production Board for defining an "Accredited School."

The latest instruction code has been considerably expanded. Its sections include: equipment and facilities of the school, qualifications and duties of the instructor, instruction in welding practice, instruction in welding theory, final tests. There are also nine appendices of supplementary material given as suggestions.

The welding school, the code provides, shall be equipped with at least 75% as many arc welders or welding outlets as there are students in the shop class. At least 50% of the welding stations should be D-C, but at least one A-C transformer-type welder should be available.

With regard to instruction hours, it is required that each student devote a minimum of 150 hr to actual welding —exclusive of time spent in witnessing demonstrations, preparing plates for welding, testing specimens, etc. — but not over 6 hr in actual welding practice in any one day. At least 20 hr must be devoted to instruction in welding theory.

Under this code, an instructor qualified to teach welding must possess a minimum of three years' total experience as a welding operator or welding supervisor, at least two years of which were spent as a manual metal arc welding operator. He must also be able to pass all of the tests prescribed for students.

This code is published in the form of a 68-page booklet entitled, "Code of Minimum Requirements for Instruction of Welding Operators, Part A-Arc Welding of Steel ⅛ to ¾ In. Thick" and may be obtained at 50c per copy from the American Welding Society, 33 W. 39th St., New York City.

» «

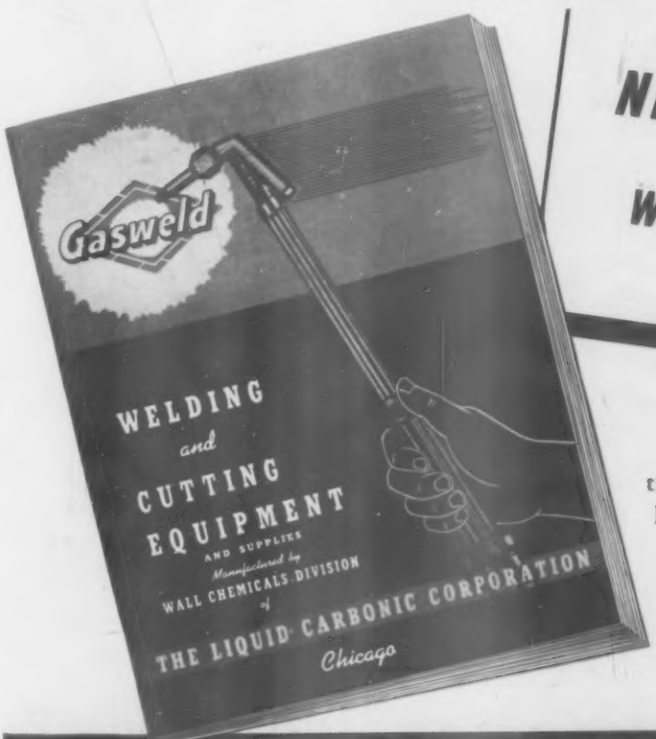
New Welding Jobber for Northern Ohio

The Scott-Tarbell Co., 2261 E. 14th St., Cleveland, has been formed to distribute several lines of welding products in Northern Ohio. The new welding supply jobber will represent Allis-Chalmers Co., Victor Equipment Co., Tweco Products Co., Una Welding, Inc., and will also offer a consulting engineering service. The firm members are **Ray Tarbell,** formerly with the Una Welding Co., and **Ed Scott,** who has been and continues as president of The Cleveland School of Welding.

» «

Moslo Machinery Enlarges Factory

Moslo Machinery Co., Cleveland, has moved to new quarters at 2443 Prospect Ave. that are three times as large as the concern's former quarters. A completely staffed engineering department is available for the design of special equipment, and ample shop space is devoted to production. Among other work in progress, this company is producing a complete plant for the production of welding electrodes, under orders of one of the United Nations governments.



NEW Gasweld CATALOG

Welding Apparatus Geared to War-time Needs

● "Gasweld" welding equipment, known to the trade for efficiency and dependability since 1932, is now produced by the Liquid Carbonic Corporation.

The new Gasweld Equipment Catalog illustrated here is the first to be issued under the new organization. It illustrates and describes many new pieces of apparatus and greatly expanded service facilities that have been developed to meet the needs of a nation geared to the greatest production program in history.

Send for your copy.

Buffalo, N. Y.
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Chicago, Ill.
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Louisville, Ky.
Milwaukee, Wis.

WALL CHEMICALS DIVISION OF
THE Liquid CARBONIC CORPORATION
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Rochester, N. Y.
Toledo, Ohio
Canada:
Montreal, Quebec
Toronto, Ontario
Windsor, Ontario

International Acetylene Ass'n Meets at Cleveland, Oct. 14

The 1942 annual meeting of the International Acetylene Association will be held at the Hotel Cleveland, Cleveland, October 14. A separate business meeting will be held, followed by a dinner, during which the Morehead Medal will be awarded.

» «

Pipe Line Contracts

H. C. Price Co., electric welding contractor of Bartlesville, Okla., has been awarded contracts for arc welding five major pipe lines, These are:

Phillips Petroleum Co., 67 miles of 8-in. loops in Kansas and Missouri. General contractor, O. E. Dempsey Construction Co.

Phillips Petroleum Co., 237 miles of 8-in., 54 miles of 6-in. line from Goldssmith, Tex., to Borger, Tex. General contractor, O. E. Dempsey Construction Co.

Illinois Pipe Line Co., 150 miles of 8-in. line from Lima, O., to Canton, O. General contractor, Sheehan Pipe Line Construction Co.

War Emergency Pipe Lines, Inc., 80 miles of 24-in. line running in a northeasterly direction from the Texas-Arkansas state line. General contractor, O. E. Dempsey Construction Co.

Dow Chemical Co., 20 miles of 3-in., 4-in., 6-in., 8-in., 10-in., 12-in., and 14-in. line near Ludington, Mich. General contractor, Dowding Truck & Transfer.

» «

Safety Congress, Chicago, Oct. 27-29

"Save manpower for warpower!" is the theme of the 31st National Safety Congress and Exposition, to be held in Chicago, Oct. 27-29, under auspices of the National Safety Council. The entire program, covering every phase of safety with 175 sessions and 500 program participants, will be centered on the problem of stopping accidents that slow production.

» «

New Sales Agent

Walter Smith Battery & Welding Service, Milton, N. Y., has been appointed non-exclusive agent for P&H welders and electrodes in Ulster, Sullivan and Delaware counties, New York. The new agent will operate under supervision of the New York City branch office of the Harnischfeger Corp., Milwaukee.

» «

Ohmite Expands Factory

A large expansion in factory space and production facilities has been made by the Ohmite Mfg., 4835 Flournoy St., Chicago.

ABOUT PEOPLE

Bent Laune has been appointed eastern sales manager of **Eutectic Welding Alloys, Inc.,** 40 Worth St., New York City. From 1933 to 1941 he was with the Welding Engineering Sales Corp., The Metal & Thermit Corp., and the Westinghouse Electric Mfg. Co.

» «

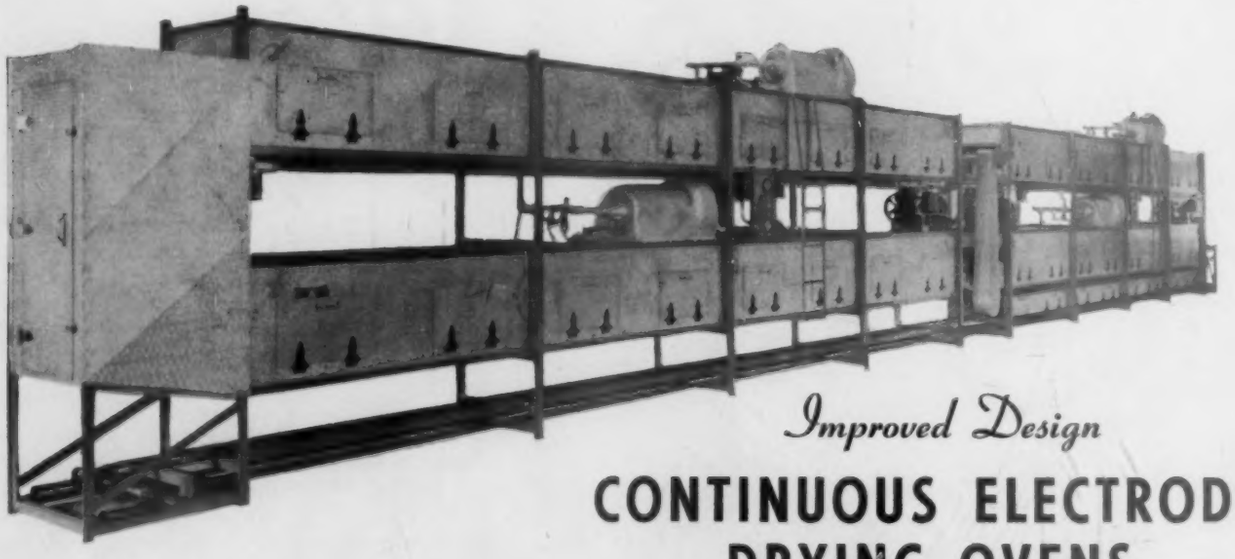
L. G. Danielson, sales representative of the **Harnischfeger Corp.,** Milwaukee, is again working out of the Chicago office. He had absented himself from the Chicago territory in order to cover the state of Iowa for Harnischfeger.

» «

Wallace T. Montague has been elected a vice-president of Norton Co., Worcester, Mass. He is in charge of sales planning and development at Norton and was formerly assistant vice-president.

» «

R. J. Hearn has been appointed manager of the Boston district office of the **Crocker-Wheeler Electric Mfg. Co.** He was formerly a sales and service engineer for the Allis Chalmers Mfg. Co.



Improved Design

CONTINUOUS ELECTRODE DRYING OVENS

Steiner Oven Division STEINER OVENS FOR BEST RESULTS **STEINER-IVES CO.**

16 AVENUE L, NEWARK, N. J.

Wear Proofing

For wearing parts!

Coal Cutter Bits, hard-faced with Borod, are saving one company over $1,800 per year. One pound of ¼" bare Borod costs only $5.50 and will tip the points of 4,000 bits!

Tractor Parts—Cleats, track rails, rollers and sprockets, hard-faced with Stoody Self-Hardening, give considerably longer service than new, unprotected parts. Cost of rebuilding is approximately ⅓ the cost of a new part.

It's common sense that ANY part subjected to abrasion is going to wear—and sooner or later wear necessitates replacements. With new parts so hard to get, Stoody Alloys are more important than ever for keeping your equipment in operation. Their big advantage over ordinary rods or electrodes is that parts reclaimed with Stoody Alloys invariably outlast new, unprotected equipment! Applications can be made by either acetylene or electric methods and rebuilding cost is usually a fraction of new part cost.

Illustrated are a few typical examples where Stoody Alloys are being used to save replacements and reduce operating costs.

Ask for our new bulletin, "Hardfacing—Industry's Weapon Against Wear"... Illustrates and describes dozens of hard-facing applications in many industries. Chock full of useful information that can save you money every day of the year!

Worn Gyratory Crushers, used in crushing copper ore, give twelve months efficient production when rebuilt with Stoody Manganese and hard-faced with Stoody Self-Hardening, against a normal, unprotected life of only eight months. Furthermore, expensive shutdowns are reduced and the rebuilding operation can be repeated as often as necessary.

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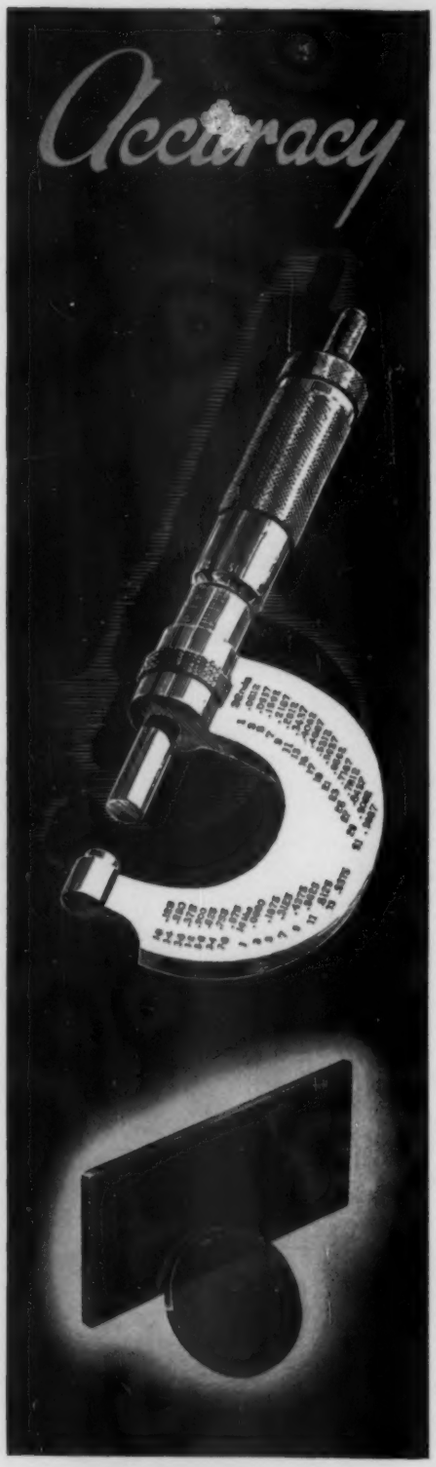
STOODY COMPANY *Hard Facing Alloys*



All lenses in Willson Industrial and Welding Goggles and Welding Helmets are individually tested for accuracy and must exceed Federal specifications for proper protection.

Call your local Willson Representative or write direct for information on the complete line of Willson Goggles, Respirators and Helmets.

GOGGLES • RESPIRATORS • GAS MASKS • HELMETS

DOUBLE WILLSON

PRODUCTS INCORPORATED

READING, PA. U.S.A. Established 1870

Elmer W. Silver, secretary of the **Whitehead Metal Products Co., Inc.,** has been elected to the additional office of treasurer. In this position, he will succeed the late **William L. Rianhard.**

» «

Died . . .

Edward W. P. Smith, 56-year-old consulting engineer for The Lincoln Electric Co., Cleveland, was found dead the morning of September 19 in his berth aboard a train bringing him back to Cleveland. He had been addressing a meeting of the American Welding Society at Indianapolis and had boarded the train immediately after the meeting.

A recognized authority on arc welding, Mr. Smith gave special courses at the Lincoln plant each month on designing for welding. He developed several original methods of demonstrating the stresses in metals and was to have been chairman of a number of technical sessions at the October convention of the American Welding Society.

Harry T. Thompson, district manager of the Metal & Thermit Corp., died at his home in Mt. Lebanon, Pa., on August 19. He was 53 years old.

Mr. Thompson served as a captain in the Field Artillery during World War I. Returning to civilian life, he became associated with the Differential Steel Car Co., Findlay, O., of which he later became vice-president and director. In 1931, he joined the sales organization of the Metal & Thermit Corp.

» «

Gustav E. Harcke, for 26 years an employee of the Air Reduction Sales Co., New York City, died on August 2. He was 64 years old.

Mr. Harcke was for many years active in conducting liquid air demonstrations. More recently, however, he had been giving his time to building up the engineering and data files of Airco's general library.

» «

Thomas A. Callaghan, president of the Federal Pipe and Supply Co., Chicago, died on Friday, August 21.

Helpful Literature Just Published

Aircraft Welding Data

An emergency Standard on the spot welding of aluminum alloys in aircraft, **"Tentative Standards and Recommended Practices and Procedures for Spot Welding Aluminum Alloys,"** has just been published as a 48-page, 8½ by 11 in. pamphlet. Copies may be obtained at $1 each at the **American Welding Society,** 33 W. 39th St., New York City.

This report is the result of nine months of concentrated work by an AWS technical committee. The subjects covered include: standards of weld quality, surface preparation for spot welding, welding technique, methods of testing, methods of inspection, design of spot-welded parts, welding equipment and installation. A short dissertation on personnel requirements and production methods is also included.

» «

Low-Temperature Welding Book

A complete and authoritative **presentation of the Castolin Eutectic low-temperature welding process** has just been published. This 40-page, letterhead-size data book explains in detail the method of welding with low-temperature eutectic alloys and their "Autochemic" fluxes and gives welding instructions for cast iron, iron and steel, aluminum and aluminum alloys, brass, bronze and copper, nickel and its alloys, magnesium, etc. A special section tells of the adaptability of the Castolin Eutectic process to specific war production tasks; other sections cover such subjects as "welding dissimilar metals," "production and salvaging of tools," "salvaging defective castings," "salvaging equipment and machinery." **Eutectic Welding Alloys, Inc.,** 40 Worth St., New York City.

» «

Lift Truck Bulletins

"Electric Power Trucks" and **"Gas Power Trucks"** are the titles of two letterhead-size bulletins which have been issued to describe a line of medium capacity (3,000 lb) industrial lift trucks. These trucks are of the tilting fork type, telescopic and non-telescopic. **Lewis-Shepard Sales Corp.,** 123 Walnut St., Watertown, Mass.

» «

Brazing Leaflet

"The Flux is in the Flame" is a letterhead-size leaflet describing a new method of automatic brazing. This process makes use of a liquid "Gasflux" which is inducted directly into the gas line and is discharged through the tip of the torch with the flame. **Automatic Gasflux Mfg. Co.,** Mansfield, O.

MALLORY STANDARDIZED WELDING ELECTRODES

SPEEDIER PRODUCTION

BETTER WELDING

LESS DOWN TIME

LOWER COST

Resistance Welding Wins Its Wings By Speeding Aircraft Production

One reason why American fighters and bombers have earned their high reputation in sky-battles . . . and why their output has increased so hugely in recent months . . . is the increased use of resistance welding. In many leading aircraft plants, airplanes are built *faster*, more economically, lighter in weight and with improved design . . . thanks to standardized spot welding tips and holders, seam welding wheels and flash welding dies supplied by Mallory.

During the past three years, resistance welding with Mallory Standardized Welding Electrodes has revolutionized aircraft assembly methods. Before 1940, only such non-structural parts as switch boxes, air ducts, cover plates, map cases, ammunition boxes and radio antenna masts were resistance welded. Secondary structures such as engine and nacelle cowlings, fairings by the wings and fuselage between stabilizer and elevator, door and window frames, fuselage bulkheads and pilot seats were soon successfully spot welded. Today, there is a growing list of additional aircraft parts . . . many of them primary stressed structures . . . which are speeded to completion in resistance welding machines.

It's natural, because of Mallory's pioneer developments in better electrode materials, designs, holders and cooling methods, that Mallory Resistance Welding Electrodes are specified by welding engineers in major aircraft plants all over the country. Mallory Standardized Spot Welding Tips, for instance, will give you more spots between dressings . . . a far higher total number of welds before replacement is necessary . . . and stronger, cleaner welds at low cost.

Ask MALLORY engineers to help you specify the correct resistance welding electrode for each job. Also, you'll want your free copy of the fact-filled MALLORY RESISTANCE WELDING DATA BOOK. Write us today!

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RESISTANCE WELDING — P. R. MALLORY & CO. Inc. MALLORY — STANDARDIZED ELECTRODES

We're Welding a White-Hot Welcome

for Aggressors . . .

CUE FOR YOU TO JOIN

THE AMERICAN WELDING SOCIETY

SHELLS seam-welded, 300 an hour by one man and one machine . . . warplane output speeded up 30% by spot welding . . . freighter production 37.5% faster, thanks to arc welding . . . so go the averages, as America has gone to war.

You'd probably like to meet the men who are helping to hang new production records "on the hook" every few days, in industries all over the country. One of the best ways to meet them is to join the American Welding Society.

The Society's meetings, research program, and the pages of its publications have attracted key men in practically every field . . . engineers, executives, purchasing agents, foremen, welders, inspectors, professors, students, research workers, draftsmen, designers.

Here's what the Society and its 5500 members offer you in 1942:

1. **An opportunity to meet and talk with leaders of the welding industry at monthly Section meetings, at the annual meeting, and at other regional and national meetings.**
2. **A key to new ideas and the latest progress in the art. Code service for Sustaining Members, with up-to-date bulletins.**
3. **A chance to take an active part in developing better welding techniques and new applications. Research conducted under the auspices of the Welding Research Committee.**
4. **Membership Certificate; Membership Emblem (available at nominal cost).**
5. **YEAR BOOK telling "who's who" in welding.**

COST: Sustaining Membership, $100; Membership, $15; Associate Membership, $10; Operating Membership, $5; Student Memberships, $2.50 a year.

The American Welding Society provides you who are interested in welding with a growing fund of data and ideas . . . any one of which may be worth many times the cost of many years' membership to you. Please write me for a free copy of our informative booklet on the Society.

J. D. TEBBEN, Chairman Membership Committee
THE AMERICAN WELDING SOCIETY
33 West Thirty-Ninth Street,
New York, N. Y.

LARKIN arc welders

and **LARKIN REPRESENTATIVES**
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Atlanta, Ga. 660 Darlington Rd.	**Portland, Oregon** 526 N.W. Hoyt St.

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Aircraft, Tanks, Munitions, Naval Vessels and Other War Time Necessities

Speedy Deliveries

Write for catalogue No. 90A for details.

Model # 400C (40-400 amperes)
Most popular size these days

MANUFACTURED BY

LARKIN LECTRO PRODUCTS CORP.

220 Taaffe Place, Brooklyn, N. Y. • Sales offices throughout the country

Maximum Price Manual

The Office of Price Administration has began quantity distribution of **Manual No. 2,** explaining how the service trades price regulation (Maximum Price Regulation No. 165 as Amended —Services) applies to the more than 600,000 service establishments throughout the country.

Similar in scope to Bulletin No. 2, which explained to retailers the operation of the General Maximum Price Regulation, Manual No. 2 is intended to help the many service trades affected to understand the provisions of the service trades price regulation and to check their ceiling prices under its terms.

Services whose maximum prices are established by the regulation are listed in the manual. The 61 classes of service businesses regulated embrace among others the maintenance, rental and repair of many commodities, including automobiles, aircraft, boats, electrical appliances, furniture, and equipment for offices or stores. The included services range from laundering and dry cleaning to window cleaning and stevedoring. Commission selling, custom processing of many commodities, and transportation brokerage are other services covered.

The manual explains how to arrive at maximum prices under the service trades price regulation, and various other requirements which service establishments must meet.

Manual No. 2 is being distributed through **all Regional and State OPA Offices** and War Price and Rationing Boards, as well as through various trade associations.

» «

Atomic-Hydrogen Bulletin

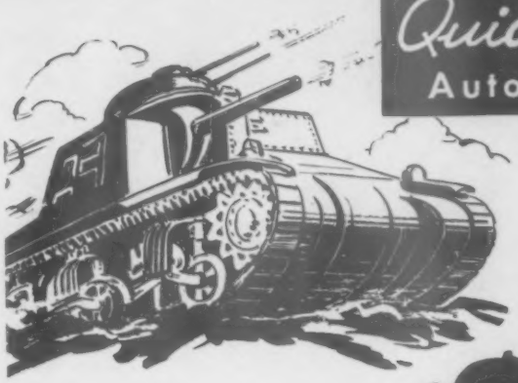
A new 16-page illustrated bulletin, **GET-1062,** describes in considerable detail the progressive steps in the adjustment and operation of the atomic-hydrogen electrode holder. "Right" and "wrong" methods of adjusting the electrodes and the hydrogen supply, striking the arc, controlling the arc length and current setting, starting the weld, etc., are treated at length. This bulletin is of letterhead size, well illustrated and organized for quick reference. **General Electric Co.,** Schenectady, N. Y.

» «

Engineering Training Manual

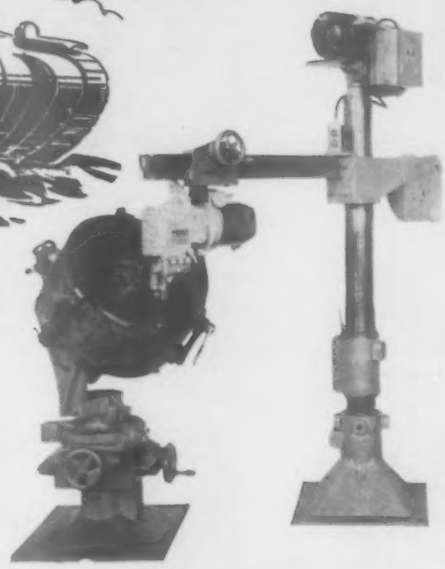
A guidance manual for engineers and committees acting in an advisory capacity to high school students considering engineering careers has just been issued by the **Engineers' Council for Professional Development,** 29 W. 39th St., New York City. This **"Manual for Committees of Engineers Interested in Engineering Education and the Engineering Profession"** is published with a separately-bound appendix addressed to the student as a prospective engineer. Single copies of the manual with appendix may be obtained from ECPD headquarters at ten cents; copies of the appendix only at five cents.

Quicker Welding . . With This Automatic Welding Machine Fixture



THIS Acme dual fixture arrangement permits practically constant use of an automatic welding head, because one of the fixtures can be reloaded while the other is engaged in the welding operation.

The holding machine can be set at vertical, horizontal, or angle. (Illustration shows a wheel being welded at 45° angle.) Positioner arm swings from one fixture to the other, locking in proper position. Speed of rotating the work is adjustable, as desired.



Reloading Is done During Welding Operation

ACME Manufacturing Co.
1642 HOWARD ST. • DETROIT, MICH.

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for information relating to your particular welding-fixture problem.

SPECIALISTS

In Processing Machinery For The Welding Rod Manufacturing Industry

- Welding Rod Feeding Machines
- Extrusion Die Heads
- End Brushing Machine
- Mixers
- Flux Coating Center Gauge
- Welding Rod Extruding Presses
- Take-Away Conveyor and Belts
- Conveyor-Type Electrode Oven
- Scales
- Slug Presses
- Wire Straightening and Cutting Machines

We maintain a complete Engineering Department, and are in a position to design and build any auxiliary equipment which you may need.

You are cordially invited to inspect our new offices and plant, together with any equipment we have on the floor during the week of the National Metal Exposition, or at any time you are in Cleveland.

NOTE: We Are Only a Five-Minute Taxi Ride from the Exposition Hall.

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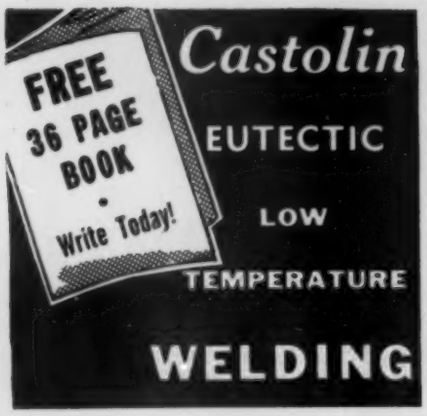
MAin 8864



GET this important free book today. It shows how effective Castolin Eutectic Low Temperature Welding is with oxy-acetylene, metallic arc, or high frequency equipment. What's more, you get valuable hints on salvaging machinery, speeding fabrication of parts, welding dissimilar metals, and salvaging tools and defective castings. Contains 96 illustrations. Write on your company letterhead for your copy.

•

Speed Production! Save Labor and Vital Materials! Salvage Expensive Castings Easily . . . Economically!

•

Welds: Cast Iron—Iron—Nickel—Steel—Aluminum—Bronze—Copper—Brass—Magnesium—etc.

•

See our demonstration at booth No. E140, National Metal Exposition, Cleveland. From Oct. 12 to 16.

EUTECTIC
WELDING ALLOYS, Inc.
40 Worth St., New York, N. Y.

Steel Products Manual

American Iron and Steel Institute, 350 Fifth Ave., New York City, announces the publication of Section 11 of the Steel Products Manual, **Carbon Steel Sheets.** This is a 94-page booklet, 6 by 9 in., divided into four comprehensive parts. Part I covers general definitions and manufacturing practices, Part II chemical practices, Part III standard mill practices and Part IV standard methods for packaging, loading and shipping flat steel sheets.

» «

A-C Welder Booklet

Westinghouse **B-3090** is an 8-page, letterhead-size booklet describing A-C welders for use with the Unionmelt automatic welding process. The booklet lists the specific advantages of submerged melt welding and explains how this process is now being used to speed war production. Department 7-N-20, **Westinghouse Electric and Mfg. Co.,** East Pittsburgh, Pa.

» «

Valve Repair Bulletin

"How to Repair Valves" is the title of a new 6-page, letterhead-size bulletin just issued for maintenance men, operating engineers, pipe fitters and plant executives. It explains and illustrates the various steps to take in repairing leaky gate and globe valves and gives hints on how to reclaim discarded valves. **Crane Co.,** 836 S. Michigan Ave., Chicago.

» «

Welding Catalog

A new edition of the **"Spe-Weld" catalog** has just been printed. This is a 16-page booklet, 3½ by 8½ in., which covers various types of oxy-acetylene welding and brazing rods, fluxes and shielded-arc type and coated electrodes. Welding instructions are given for each type of rod and electrode. **Special Welding Alloy Co., Inc.,** 27-26 Jackson Ave., Long Island City, N. Y.

» «

Lathe Manual

"The Care and Operation of a Lathe" is a pocket-size, paper-covered manual written for the apprentice or student machinist. Topics covered are: parts and functions of a modern screw cutting lathe, its oiling and proper care, the grinding of cutters, modern lathe tools, the performance of basic lathe operations. Single copies of this book may be obtained at 50c each (discounts for quantity buyers) from the **Sheldon Machine Co., Inc.,** Chicago.

» «

Hoist Catalog

Coffing Catalog No. G-6 is a 12-page, letterhead-size bulletin devoted to various types of hoists and related products. It pictures and describes ratchet lever hoists, safety load binders, utility maintenance tools, electric hoists, electric hoist accessories, spur gear chain hoists, differential chain hoists, I-beam trolleys, ratchet lever hoist parts, load binder parts, spur gear hoist parts and the like. **Coffing Hoist Co.,** Danville, Ill.

» «

Heat Transfer Data

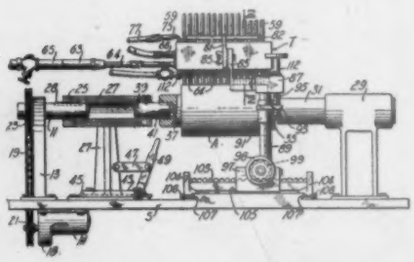
"Heat Transfer through Metallic Walls" is the title of a 16-page booklet prepared from data compiled by the Development & Research Div., of the **International Nickel Co., Inc.,** 67 Wall St., New York City. This booklet discusses the various factors influencing transfer through metallic walls, including the thermal conductivities of commonly used metals and alloys. Formulae are given for determining overall heat transfer rates.

» «

FROM THE PATENT OFFICE

Metal-Coating Apparatus

2,295,701. **Robert Luther Wagner,** Niagara Falls, N. Y., assigned to **Haynes Stellite Co.,** Kokomo, Ind. Filed Sept. 1, 1939. Issued Sept. 15, 1942. A process of forming a uniform metallic overlay



of a surfacing metal upon the surface of an article and the apparatus for applying the welded-on overlay. Process comprises concurrently guiding a plurality of closely-spaced rods of the surfacing metal into an elongated narrow welding zone on the surface of the article to be coated. The bodies of surfacing metal are moved at a uniform rate in a direction transversely of the length of the welding zone. A means is provided for directing a plurality of closely-spaced flames, arranged in a long and narrow row, against the rods and surface to be coated. The thickness of the metallic overlay deposited is controlled by maintaining a substantially uniform rate of melting of the coating rods. Relative movement is effected between the flame-directing means and the rod directing means, as a unit, and the surface in a direction transversely of the length of row of welding flames. Relative movement is likewise effected between the flame-directing means and the rod-directing means, as a unit, and the surface in a direction lengthwise of the flames.

-2-TIME PROVEN

Time, Labor and Money Savers

SPATTER-EX. the original coating to prevent bonding of welding spatter to metal parts — recommended for single pass welding. A water soluble compound, non-inflammable, harmless to human skin, easily cleanable.

FLASH-EX for preventing spatter sticking to parts in multipass welding and for use on metal having greater heat conductivity than steel or iron.

FLASH-EX is also widely used in resistance welding to prevent welding holder jaws becoming jammed with flash. Greatly increases life of these expensive and hard to get parts.

Both compounds are in daily use by many of the largest War Plants.

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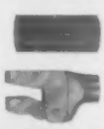

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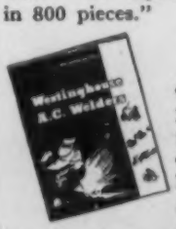

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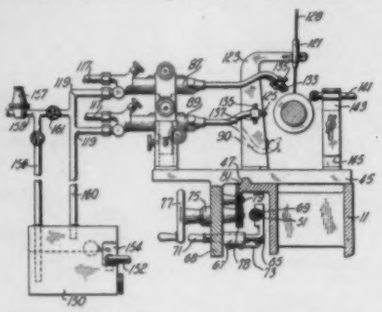
Metal-Coating Apparatus

2,295,702. **William Arthur Wissler,** Niagara Falls, N. Y., assigned to **Haynes Stellite Co.,** Kokomo, Ind. Filed Sept. 1, 1939. Issued Sept. 15, 1942. A method



and process of forming a metallic coating upon an elongated metal surface of revolution. The steps are: rotating the surface at a uniform speed about a longitudinal axis; applying a flame against the surface to heat it to welding temperature and also provide sufficient heat to melt a body of coating metal; feeding the body of coating metal into the flame, thereby melting portions of it and depositing the molten metal upon successive portions of the rotating surface; moving the welding flame and body of coating metal in unison longitudinally along the rotating surface, thereby producing a continuous spiral deposit of metal upon the surface; correlating the intensity of the flame, the rate of rotation of the surface and the rate of movement of the flame and body of coating metal so that this spiral deposit is of substantially uniform width and thickness throughout and the adjoining convolutions are sufficiently close together to provide a continuous and substantially uniform metallic coating.

» «

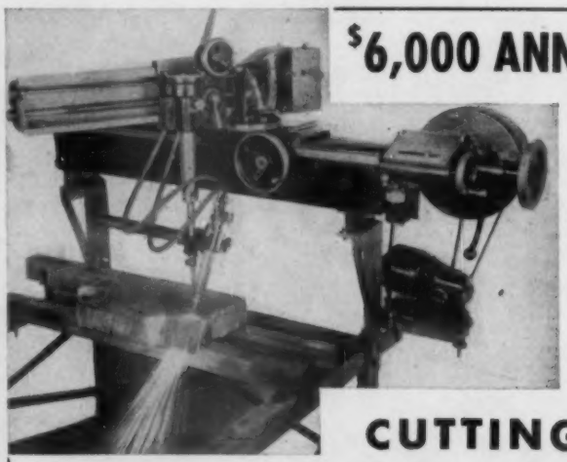
Electrode Holder

2,295,546. **George A. Combridge,** Los Angeles, Calif. Filed Jan. 10, 1941. Issued Sept. 15, 1942. This patent pertains to the handle of an electrode holder and the means for detachably clamping an electrode. The handle has a transverse slot in which a plunger slides transversely of the handle. A spring tends to slide the plunger outwardly for shifting the means of clamping to clamping position, while a finger-piece at the outer end of the plunger slides it inwardly for shifting the clamping means to releasing position.

» «

Multiple Spot Welder

2,295,925. **Edward G. Biederman** and **Delmar S. Harder,** Detroit, assigned to **General Motors Corp.,** Detroit. This patent pertains to a machine for multiple spot welding, having a plurality of primary circuits in inductive relation, each with a plurality of electrode



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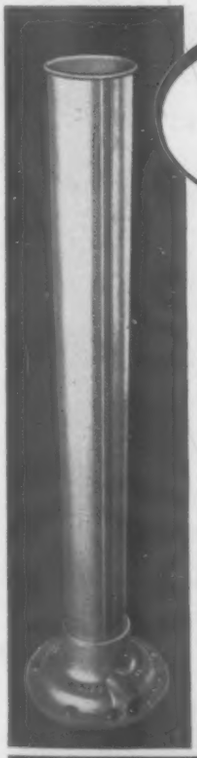

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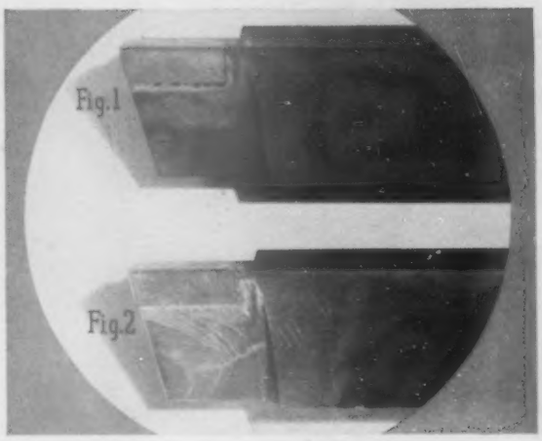

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circuits. A means is provided for successively closing and opening the primary circuits so that only the group of electrodes associated with one primary is energized at one time. Also included are a fluid-operated means for bringing the electrode pads into contact with the work, another fluid-operated means controlled by the operation of the first for bringing the electrodes and for individually supporting each electrode into contact with the work, a common supply of fluid being open to all the individual fluid-operated electrode supporting means at one time.

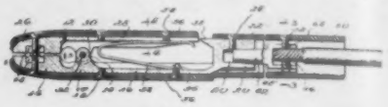
Automatic Arc Welder

2,294,312. **Vernon E. Mann,** Scotia, N. Y., assigned to **General Electric Co.** Filed Aug. 24, 1940. Issued Aug. 25, 1942. This patent pertains to an automatic arc welding apparatus comprising an electrode holder, a means for feeding the holder toward and away from the work in order to strike and maintain an arc and a means for returning the holder to a loading position. The return is accomplished by a means which includes a limit switch responsive to the spacing of the electrode holder from the work and a second limit switch responsive to the position of the work at the end of a welding operation. The holder is returned its loading position when the consumption of an electrode has exceeded a predetermined amount.

» «

Electrode Holder

2,294,321. **Walter C. Schulfer, Jr.,** Summit, Ill. Filed July 25, 1941. Issued Aug. 25, 1942. In this holder, the electrode is



clamped by a pair of jaws. Rearwardly from the jaws, extend arms which are substantially parallel when the jaws are closed. The arms are connected by a hinge at a point adjacent jaws, and one arm is materially longer than the other. The longer arm has a portion offset into substantial alignment with, and closely adjacent to, the rearward end of the shorter arm when the jaws are closed; this offset portion is included in the handle surrounding the rearward end of the longer arm. Thus the holder is substantially smooth in configuration on both sides and is symmetrical in formation without projecting elements.

» «

Spot Welding Circuit

2,294,388. **John W. Dawson,** Auburndale, Mass, assigned to **Raytheon Mfg. Co.,** Newton, Mass. Filed Jan. 2, 1940. Issued Sept. 1, 1942. A circuit involving use of electronic tubes. System comprises a transformer having a magnetic core and windings provided with input and output connections, a circuit connected to the output of transformer, means for supplying to the input a pulse of current having a substantial D-C component for individual operations and means for continuously impressing on the core a magneto-motive force having a substantial unidirectional component opposite in direction to the magneto-motive force exerted on the core by the first-mentioned D-C component.

» «

Torch Nozzle

2,294,392. **Eduard J. W. Egger,** Bellevue, Pa., **Casimir V. Johanson,** Cranford, N. J., and **Ray B. Smith,** Pittsburgh, assigned to **The Linde Air Products Co.** Filed Jan. 14, 1939. Issued Sept. 1, 1942. A torch nozzle adapted to be guided along and in contact with a work surface. Combination comprises a nozzle body, a metal ring and a layer of metal which is resistant at high temperatures to abrasion, deformation and oxidation. Ring is secured behind but adjacent to the front face of nozzle. Metal layer is permanently united to the periphery of the ring, forming therewith a composite collar the periphery of which extends outwardly be-

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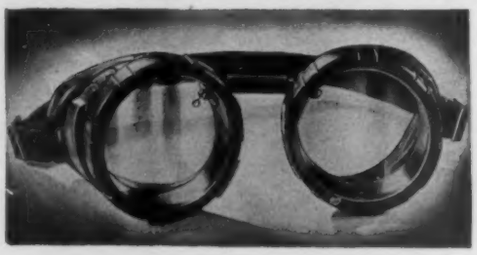

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yond the periphery of the nozzle body. Ring is made from high chromium steel, and the layer of wear-resistant metal is a metal alloy, 35 to 90 per cent of which is from the group consisting of chromium, molybdenum and tungsten and the remainder principally comprising metal from the group consisting of iron, nickel and cobalt.

» «

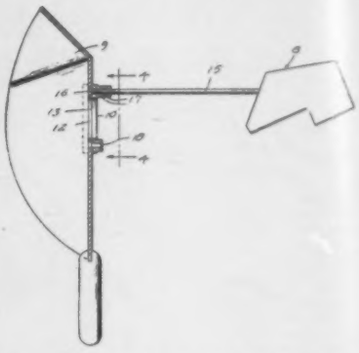
Arc Welding Method

2,294,650. **Joseph F. Bechtle,** Jersey City, N. J., assigned to **The M. W. Kellogg Co.,** New York City. Filed Nov. 9, 1940. Issued Sept. 1, 1942. This patent pertains to a method of seam welding metal articles which are to be joined over a groove in a metal mold piece. Steps comprise positioning a pair of the edges to be joined, providing a lining of molten flux to cover the surface of the groove, filling the lined groove with molten metal while maintaining the flux lining on the surface of the groove and coalescing the molten metal in the groove with the metal of the edges.

» «

Shield Attachment

2,294,799. **Martin Olsen,** Jersey City, N. J. Filed Nov. 18, 1940. Issued Sept. 1, 1942. This patent pertains to a shield shaped to cover the front head and



neck portion of a weldor. The shield has a sight opening, a socket secured to the front of shield adjacent the sight opening and a rod detachably connected to the socket. Extending forwardly of the shield, this rod supports a periscopic reflector member on its outer end.

» «

Hard-Facing Alloy

2,294,834. **Hugh S. Cooper,** Cleveland, O., assigned one-half to **Frank H. Wilson,** Cleveland. Filed June 5, 1941. Issued Sept. 1, 1942. A hard-facing alloy for iron and steel foundation metal; this alloy is characterized by having a hardness within the range 60 to 70 Rockwell C that is substantially unaltered by fusion and re-solidification. Alloy consists of chromium 20-70%, columbium 0.50-5.0%, carbon 1 to 3%, manganese and silicon from small fractional percentages up to 3% each, and the balance iron.

» «

Pipe Cutting Machine

2,295,182. **James Norton,** Tulsa, Okla. Filed Sept. 11, 1940. Issued Sept. 8, 1942. A pipe-cuting machine comprising a cradle for the pipe, means for rotating pipe, a cutting torch slidably mounted longitudinally of the axis of the pipe, means for reciprocating the torch and interchangeable gearing, interposed between the pipe rotating means and torch reciprocating means, for varying the speed of the torch. Torch may be caused to move in reverse directions during a 90 deg rotation of the pipe.

» «

Flame-Hardening Machine

2,294,063. **Richard J. Wolf,** Chicago. Filed July 12, 1941. Issued Aug. 25, 1942. This patent pertains to a flame-hardening device for bevel gears and the like. It includes a support for mounting the gear to be treated, a pair of related combined flame and quenching devices adapted for linear movement radially of the gear adjacent the gear teeth, a means for mounting the aforementioned devices in adjustable relation circumferentially about the gear, a means for moving the pair of devices radially along the gear teeth to progressively heat and quench teeth.

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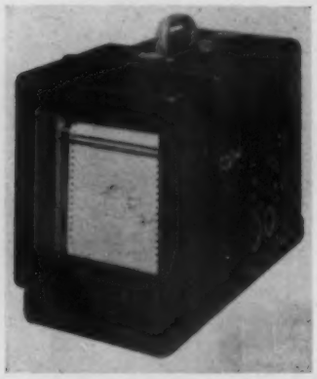

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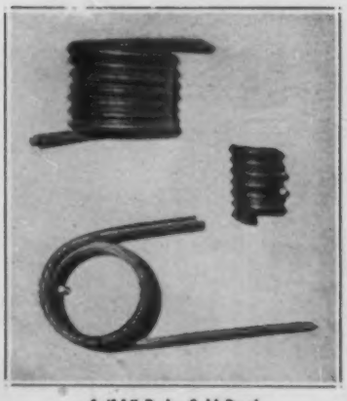

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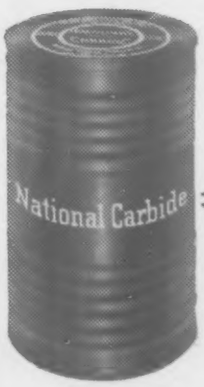

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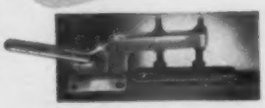

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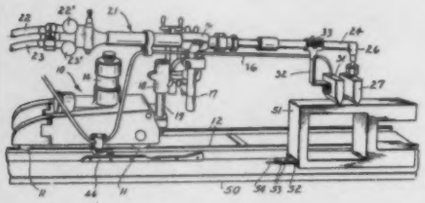
Flame-Hardening Machine

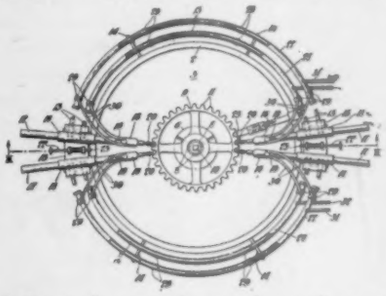
2,294,161. **John J. Crowe,** Westfield, N. J., assigned to **Air Reduction Co., Inc.,** New York City. Filed Dec. 10, 1940. Issued Aug. 25, 1942. This patent pertains to a method of producing a more uniformly hardened face on a work-piece that is of variable thickness and of material that can be hardened by cooling quickly from above a critical temperature. Method comprises (1) heating the face to be hardened by means of flames applied progressively to the face in a manner that supplies substantially equal heat input to the regions of different thickness, (2) directing jets of quenching fluid against the heated face close behind the progressively-applied flames and (3) reducing the quench at regions where greater thickness of the metal causes larger heat loss by conduction.



» «

Flame-Hardening Machine

2,294,062. **Richard J. Wolf,** Chicago. Filed July 12, 1941. Issued Aug. 25, 1942. An apparatus for flame-hardening a plurality of identical spur gears and the like. Elements are a quenching tank, a chuck for supporting a vertically aligned column of the gears centrally of the tank, a trackway about the tank, and carriages, each bearing a pair of flame devices, movable on the trackway. Also provided are a means for adjustably positioning the flame devices to direct the flames inwardly toward the gear column and immediately above the level of the quenching liquid in the tank and a means for lowering the chuck and gear column into the quenching liquid.



» «

Cutting Machine Guide

2,293,853. **John H. Rountree,** Elizabeth, N. J., assigned to **The Linde Air Products Co.** Filed May 3, 1939. Issued Aug. 25, 1942. This patent pertains to an apparatus for supporting and guiding a cutting torch. An arm is adapted to be detachably connected to a movable carriage and is movable by the carriage above a generally horizontal work surface along a desired path of travel; the arm extends in a generally horizontal direction transversely of the path of travel. Beneath the arm, a torch-supporting platform is located, substantially horizontally, and pivotal links, extending between the platform and arm, are adapted to maintain the horizontal position of platform during the relative vertical movement between arm and platform. Platform is maintained at a uniform distance from the work surface by a face-engaging means. Torch-mounting device is adjustably supported on the platform and is adapted to shift the position of the discharge portion of the torch along the horizontal platform.

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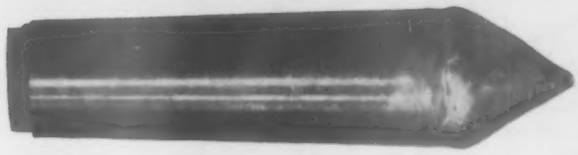

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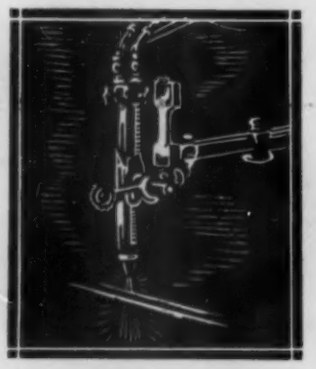

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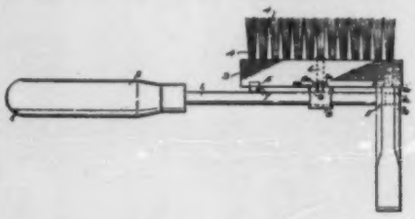
268 Northampton St., BOSTON, MASS.

Weldor's Cleaning Tool

2,293,081. **Jack L. Savoy,** Detroit. Filed Jan. 24, 1941. Issued Aug. 18, 1942. A



cleaning tool with a shaft at one extremity terminating in a handle. Shaft extends through an axially movable support member which holds a brush substantially parallel with the shaft, the bristles of the brush extending away from the shaft. A radial projection on the support member extends into a counterbore formed in the brush. A screw extends through the brush in threaded engagement with an aperture formed through the support member and its projection; this screw terminates against the shaft to hold the latter immovable. A means for spacing between shaft and brush extends at each extremity of the latter.

» «

Arc Welder

2,291,008. **Joseph Tyrner,** Englewood, N. J., assigned to **Air Reduction Co., Inc.,** New York City. Filed Dec. 6, 1939. Issued July 28, 1942. A D-C generator for arc welding, comprising a two-pole field magnet frame, two pole-pieces supported by the frame and located both physically and electrically diametrically opposite each other, supporting cores of such restricted cross-section that they are magnetically fully saturated under all operating conditions, a regulating core supported by the frame for movement toward and away from the second pole-piece, a two-pole armature arranged for rotation between the pole-pieces, main field coils which coöperate with and produce through the fully saturated supporting cores a working magnetic flux passing from one pole-piece to the other pole-piece through the armature, and a leakage flux passing through the regulating core. A series winding coöperates with the regulating core and produces flux only through the leakage flux path and in the same direction as the leakage flux produced by the main field coils. Increase of the flux produced through the leakage path by the series winding decreases by the same amount the working flux through the armature produced by the main field coils.

» «

Seam Welder

2,293,846. **Charles A. Nichols,** Anderson, Ind., assigned to **General Motors Corp.,** Detroit. Filed April 9, 1941. Issued Aug. 25, 1942. A resistance welder with rotatable disc electrodes which together provide a groove for receiving a butt-seam tube to be welded.. A grooved tube-supporting roller retains the tube against the electrodes; roller is rotatable about an axis generally paralleling the axis of rotation of the electrodes. Means is provided for exerting a constant force upon a lever rotatively supporting the roller in order to urge the roller against the tube and the tube against the electrodes with constant pressure. In order that the roller may track with the tube, a means is provided for swivelly supporting the lever for movement about an axis at right angles to the axes of rotation of the electrodes and roller.

» «

Torch Support

2,293,879. **James L. Anderson,** Closter, and **John H. W. Begerow,** Carlstadt, N. J., assigned to **Air Reduction Co., Inc.,** New York City. Filed Oct. 31, 1941. Issued Aug. 25, 1942. A torch cutting or welding machine including a carriage for moving a torch along a given course. A bracket is connected with the carriage and is adjustable on the carriage about a substantially vertical axis; this bracket has a cylindrical opening with a horizontally-extending axis. A shaft turned by a manually-actuated knob is journaled in the bracket; a pinion is secured to the shaft in such a position that the teeth of the pinion extend into the cylindrical opening through the bracket. A rod of circular cross-section extends through the cylindrical opening and is movable in the opening as a bearing; this rod has parallel, spaced recesses in a portion of its cylindrical surface, forming rack teeth that mesh with the teeth of the pinion. In another portion of the rod's cylindrical surface is a longitudinally extending keyway for engaging a key in the bracket. Projections extend from the key into the bracket transversely of the axis of the rod for preventing displacement of the key lengthwise of the rod. To control the friction between the rod and key, a screw is provided for holding the key against the bottom of the keyway; this screw threads through a part of the bracket into contact with the side of the key away from the rod.

New Products of 1942

(*Continued from page 86*)

Model EE-80 Producer. An all-welded-construction positioner with a capacity of 4 tons. One of the principal features is a vertical lift unit which makes it possible to lift the rotating face plate 36 in. above its normal floor height. Face plate is 60 in. in diam. Bentley Weldery, Inc., Syracuse, N. Y. **June, 1942.**

» «

Ransome Heavy-Duty Positioner. This machine will handle a maximum load of 22½ tons, with a center of gravity up to 12 in. above the table top. Work may be tilted to any position through a range of 45 deg from hori-

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zontal in one direction to a vertical position in the other. The positioner will also rotate any load up to capacity with an eccentricity up to 12 in. from center of its 84 in. square steel table top. Ransome Machinery Co., Dunellen, N. J. **August, 1942.**

» «

Lyon Hydraulic Elevating Table. A comparatively inexpensive positioner for instances where work is not to be raised more than 14 in. It will handle up to one ton on a platform 30 by 30 in. Table is elevated and lowered hydraulically by foot-pedal control and may be turned as desired on a full-circle pivot. Lyon-Raymond Corp., Greene, N. Y. **August, 1942.**

» «

Weldors' Accessories

Cover Glass Case, Electrode Carrier. Case is of chrome leather and has a snap fastener which slips on the weldor's belt. Electrode carrier is also of chrome leather; it has two compartments and is furnished with a web belt. **Safety Clothing & Equipment Co.,** Cleveland. **December, 1941.**

» «

Weldors' Tools

RH-12 Rapid Heavy-Duty Hack Saw Frame. This frame is made of solid steel, one piece, and will accommodate either hand or power hack saw blades at such tension that the blades cannot twist or turn. Rapid Mfg. Co., Inc., Glendale, Calif. **October, 1941.**

» «

Pentco Combination Snip. This snip cuts straight or curve and either right or left. It is made of chrome-vanadium-molybdenum alloy steel and is available in three sizes: No. 185 for light, general work; No. 190 for cutting up to 16 gauge; No. 195 for work up to 18 gauge.

» «

Overly Pneumatic Tools. Tools for grinding, brushing, sanding or buffing; they are available in speeds ranging from 3,100 to 11,000 rpm. Speeds are accurately governed, it is claimed, by a governor of simple construction. Charles F. Overly Co., Cleveland. **January, 1942.**

» «

File Reclamation. A service by which files are reconditioned by chemical process. It is possible, it is claimed, to obtain approximately 80% of the life of a new file from a "worn-out" file by this process, and files may be reconditioned two or three times. Special Welding Alloy Co., Long Island City, N. Y. **January, 1942.**

» «

Rod End Brushing Machine. This machine has a corrugated center conveyor belt said to maintain perfect rod alignment with rods of any diameter and ranging from 12 to 18 in. long. Action is such that no scuffing of the flux coat is possible, states manufacturer. Moslo Machinery Co., Cleveland. **March, 1942.**

» «

Cleaning Brush. A power-driven end brush designed to facilitate cleaning of slag, scale or oxidation from welds. Brush proper measures only ½ in. across the end, or brushing surface, and can be used in all standard power tools, whether air or electric. Osborn Mfg. Co., Cleveland, **April, 1942.**

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